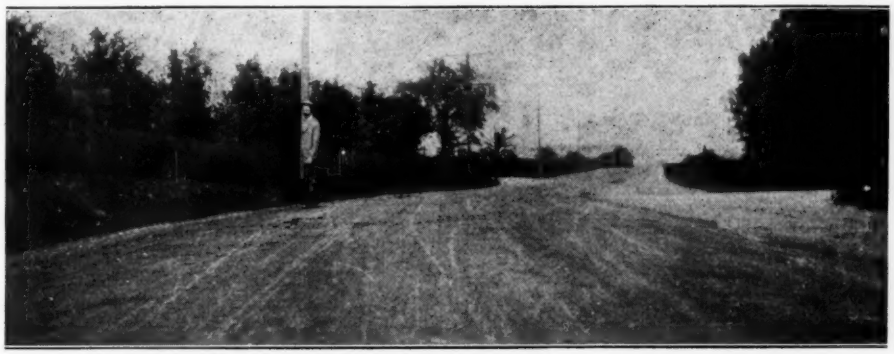
MUNICIPAL ENGINEERING

The World's Leading Municipal Publication.



Park Heights Experimental Road, Baltimore, Md.

VOL. XLIV. FEBRUARY, 1913. No. 2.

We are living in an age of scientific progress, an age in which things are happening with such rapidity that we are often bewildered. From day to day and month to month engineering developments are taking place that efficient men must, of necessity, keep informed upon. Engineering, technical and trade papers faithfully mirror and digest the best of what is constantly developing. They help to make competent men. Read your engineering papers, read your MUNICIPAL ENGINEERING *and keep informed on what is occurring of interest to you in your field of work.*

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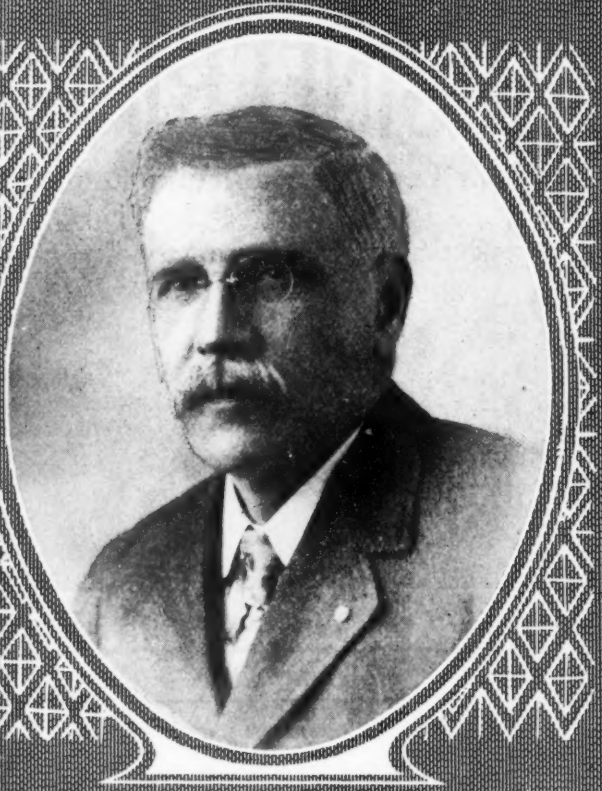


ELLIS R. DUTTON.

Assistant City Engineer, Minneapolis, Minn.

He has saved the city of Minneapolis approximately $75,000 every year for the past thirteen years on paving alone. Mr. Dutton has been eminently successful in applying the day-labor system to work of this sort. Since 1900, 2,400,0000 yards of paving have been laid in Minneapolis at a total cost of $5,500,000 and at a saving, under his method, of from 15 per cent to 20 per cent. He drafted what were probably the first creosoted wood block specifications, which prescribed the quality of oil essential to secure maximum durability.

PAVING CONDITIONS IN SOUTHERN CITIES

THE city of Birmingham, Ala., is now governed by a commission of three members, which has very large powers. It has now been in office about a year and is beginning to demonstrate its value. The members of the board are: C. Exum, A. O. Lane and James Weatherby. Their principal advisors in public improvements are the city engineer and his special assistant, Walter G. Kirkpatrick, and Maury Nicholson. The problems are numerous and difficult, for the city has absorbed all the neighboring towns and cities and is now something like 14 miles long and 4 miles wide, with large undeveloped areas lying between the various building and manufacturing centers. Before the combination each unit loaded itself up with public improvements, particularly streets and sewers, so that Greater Birmingham has a large debt to carry, and has much work demanding immediate attention in connecting the various sections of the great scattered city.

Originating Improvements in Birmingham

The new charter gives the commissioners authority to originate improvements and carry them through in spite of remonstrances, and to assess all the cost upon the property owners benefitted.

The vacant condition of much of the property on the connecting lines and the large obligations upon the city at large make them slow to begin an improvement unless it is petitioned for by those directly interested.

Birmingham has excellent bitulithic and asphalt streets, which have required little repair and are apparently capable of retaining their present good surfaces for an indefinite period. Few, if any, of them have yet passed their guaranty periods and so the repair problem has not yet become important. The city officials recognize its imminence, however, and are very desirous of keeping the quality of the pavements up to the present high standard.

Prices have been kept at reasonable figures by promises of the paving companies to those signing petitions for pavements that bids would not exceed $1.70 per square yard. This price has been possible because the base is made of slag, of which there are mountains surrounding iron furnaces within the city limits, with cement made within the city limits, or but a few miles away. Limestone is also available at reasonable cost. Brick for paving, which is of quality good enough to compare with the materials in general use, is not available at reasonable prices. No streets have traffic heavy enough to demand granite blocks. Thus far the higher cost of wooden block paving has prevented its use largely, tho some excellent wood block paving will be found in street car tracks, where conditions are usually against success with this material.

The Commission's Problem

The commission is confronted with a rather interesting situation. In its desire to meet the wishes of the property owner it awaits petitions. Many streets which are almost essential to a thorough system of paving are not paved if the property owners are left to their own initiative. Streets upon which the sentiment of the property owners is largely in favor of paving have that sentiment crystallized by means of a petition. It is

Bitustone pavement on Poplar Street, Helena, Ark. Note excellent design of street and sidewalks where levels differ much on upper and lower sides of street.

seldom that a property owner is willing to take the time and arouse the ill will of some of his neighbors by circulating the petition. It results that if the street is paved it must come from a petition circulated by the men next most interested in the pavement, the contractors who will bid on its construction. It is evident that the latter lose their interest also if the field is so open that the chances of success in obtaining the contract are reduced so much as to make the expense of securing the petition unwarrantable. The choice of the course of action to be taken by the commission is awaited with interest.

Nashville Has Its Problems

Tennessee and Arkansas were long the only states which did not recognize the principle of local assessments for local improvements and paid for all public improvements out of the proceeds of general taxes. Their constitutions contain provisions that all taxes shall be uniform, and either state directly or are construed to say that they shall be in proportion to the value of the property. All other states recognize that improvements of such nature as streets, sidewalks, sewers and in some cases water and lighting service pipes or wires are of special benefit to the property served by them and should be paid for, in part at least, by the owners of the property so benefitted. The amounts so raised are considered rather as assessments of benefits than as proceeds of taxes, and, whatever the method of spreading the assessment, the principle of proportioning it according to the benefits to the properties assessed is the basis.

An early statute in Tennessee providing that property owners should pay the cost of improving streets out to the middle thereof was declared unconstitutional, altho sidewalks and curbs are considered as belonging to the property and if the property owners did not improve them the city could do so and charge the expense to the property on which the sidewalk and curb was laid. A law passed in 1883, authorizing Nashville to assess two-thirds of the cost of improving streets upon the property benefitted was repealed in 1909, and presumably had been inactive under the court decision noted.

In 1905, however, the legislature provided for the assessment of two-thirds the cost of street improvements upon the abutting property in Knoxville, in 1907 the principle was applied to Memphis, and in 1911 to Nashville, so that the Knoxville rule now applies to all three cities.

A Successful Municipal Paving Plant

For some years before the change in the law Nashville laid pavements by day labor with its own plant. Nashville was the first city to purchase a municipal plant for laying bituminous pavements, making a special "introduction" rate with Warren Brothers Company for a plant to lay bitulithic pavement. There are several reasons for low cost of pavement. The

Bitulithic pavement on First Avenue, Birmingham, Ala., with brick in car tracks.

city, for example, owns its own stone quarries, within or close to the city limits, and crushes and hauls it to the streets, and with an average haul of a half-mile the cost does not exceed $1 a cubic yard on the streets. The stone is of superior quality and can be supplied by contractors at $1.10.

The labor at the plant consists of one man, who acts as engineer and fireman, a second man about the plant and three or four men at the drums, mixers, etc., all common labor at $2 for a 9-hour day. Warren Brothers Company furnish an expert at their own cost to supervise the operation of the plant and the laying of the pavement. Their representative in Nashville states that the resulting cost to the city of the completed pavement is $1.25 a square yard. The plant is operated during the summer time only, beginning in June or July and running until October, and as the city supplies only the common labor it is not obliged to retain an expert on an annual salary to insure good work, thus saving this expense in computing the average cost per square yard.

Good Streets are the Result

The early pavements were laid in 1902 on the most heavily traveled streets and are still in good condition, altho they have required repairs from time to time on account of the heavy traffic on them. The city is well pleased with its method of obtaining good pavements and with the cost and the results obtained, and now that two-thirds of the cost can be assessed on the property benefitted it is probable that more paving will be done than in the past. W. W. Southgate is the city engineer and Patrick Cleary is the street superintendent under whom the work is done.

Louisville Conditions

Louisville, Ky., is in still different condition regarding methods of securing public improvements and in paying for construction and reconstruction.

The property owners may be assessed for the first street improvement, whatever it may be, and any subsequent improvement of the street must be at the city's expense.

This is carried to such an extent by court decisions that a macadam road built when the property was outside the city limits has been decided to be the first improvement and a later city pavement must be paid for wholly from city funds. City streets when laid out in plats and additions may be improved with some similar cheap material at a time when such material is all that is necessary and the request for it can hardly be refused. But when conditions change, later, and a better pavement is required, the city must pay for the new pavement. The consequence has been that the demands for paving have been greater than the ability to meet them, and many expedients have been

tried to reduce the cost without diminishing quality too seriously.

New Specifications

The present administration is issuing new specifications which conform closely with the standard specifications adopted by the municipal improvement societies, and has provided itself with a new rattler for testing paving brick by the latest method, and the necessary laboratory and field facilities for full test and inspection of materials and construction.

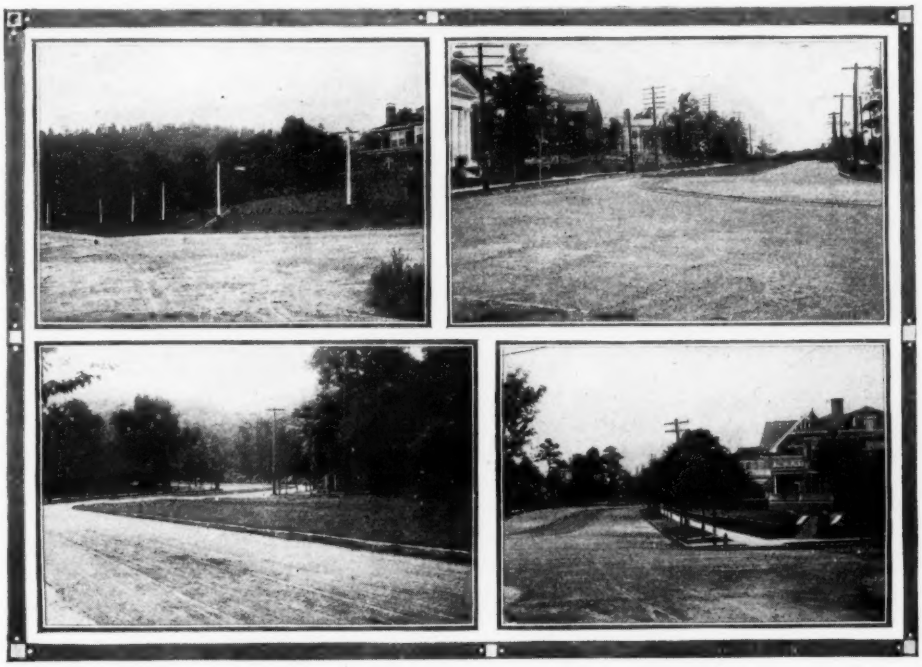
A recent court experience has led to this action as a necessary alternative to allowing the contractor to construct the street according to his own methods and accepting or rejecting the completed street. It seems that a brick street was constructed under the city's inspection, in which some defects developed after the street was finished and accepted. The attempt was made to force the contractor to put the street in good condition under his guaranty. While the contractor's claim that the fault was with the specifications and not with his workmanship was disproved by the evidence of several engineers with large experience in brick paving, the court held that the street was laid under the city's inspectors and with their approval, and, therefore, the acceptance of the street relieved the contractor of liability under his guarantee for the defects found. The case has been appealed and a reversal is expected in the higher court.

The alternative open to the city under this decision seems to be the construction of streets by the contractors without official action by inspectors, or the closest possible inspection under the most rigid specifications. Under the first the city may know in what ways the work is not properly done or in what ways the specifications are violated, and may even notify the contractor of the deficiencies, but will not relieve him of responsibility under his guarantee or from the liability of judgment against him in case suit is brought for damages on account of his violations of his contract. Under the second the city assumes all responsibility and no guarantee is necessary and it may be omitted from the specifications with a possibility that it will reduce slightly the bids for the work.

Asphalt pavement on Main Street, Memphis, Tenn. Laid by Memphis Asphalt & Paving Co. in 1906.

Shall the Guaranty Clause Be Omitted?

The latter course is advocated by the city's engineers and they are prepared to follow it to the letter if it is adopted by the department of public works. The brick specifications adopted in September for work to be done in 1913 contain the guaranty clause, but they have been brought fully up to the standard specifications and in some respects have been made still more severe, particularly in the matter of laying. The standard of loss by brick tested in the new rattler is set at 21 per cent, as compared with 22 per cent adopted by both the municipal improvement associations for streets with heavy traffic. Experience in the case referred to above seems to have led to such requirements as those that the bricks shall all be thoroughly clean before laying; that the sand cushion shall be well rolled; that, if the sand in the sand cushion works up into the joints more than three-quarters of an inch during the process of laying and rolling, the blocks shall be taken up, the cushion restored to a smooth, uniform surface and rerolled if necessary, and the bricks relaid and rolled to proper grade and surface; that expansion joints be provided around manholes and catch basins and across the carriage way at intersections as well as at the curb, and that other transverse expansion joints shall be placed as shown on plans. Brushing the surface with a soft hair brush after the joints have been thoroly filled with cement grout by the aid of squeegees is an addition, intended, no doubt, to make the surface of the street as smooth and uniform as possible and to have no low joints.



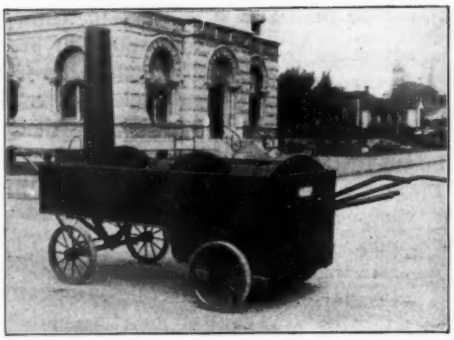
Four views of Highland Avenue, Birmingham. One of the finest residence streets in location and design in any American city. Paved with Bitulithic.

Work Done Past Year

During the last fiscal year, ending August 31, 1912, Louisville laid 15,573.5 linear feet of brick street pavements and 19,038.9 linear feet of asphalt pavements. The prices for brick paving averaged $1.83 a square yard, including the brick laid in connection with contracts for other pavements, the range in the brick pavement being between $1.75 and $1.90 a square yard, and some of the special brick work in connection with asphalt paving running as high as $2.35 a square yard.

Asphalt pavement prices averaged $1.91 a square yard, ranging between $1.75 and $2.05.

Cost of excavation in connection with pavement construction averaged 52 cents a cubic yard, range 25 to 95 cents; of embankment, 25 cents, range 10 to 45 cents; of curbing, 83 cents a



Asphalt repair wagon used in Chattanooga, Tenn.

cents a square yard; 920 feet were treated with tarvia after grading by the city's force at a total cost of the work complete of $1.19 a square yard, and 1,073.4 feet of wooden block pavement at $2.89 a square yard, replacing an old brick pavement.

The city relaid 3,800 linear feet of

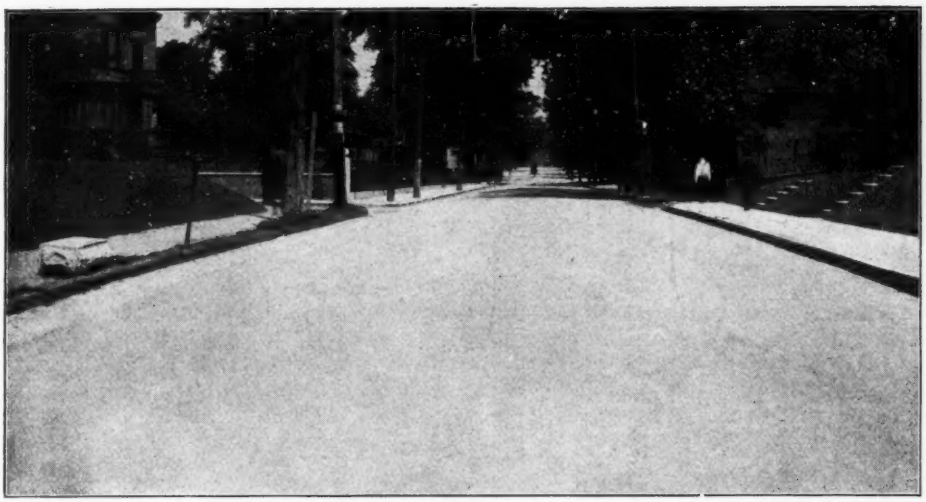
Bitulithic pavement on Broad Street, Nashville, Tenn., laid in 1903. Car tracks paved with same material. Union Station tower on background on the right.

linear foot, range 70 to 95 cents; curved curbing $1.42 cents a linear foot, range 80 cents to $1.57; binder or marginal stone 69 cents a linear foot, range 60 to 81 cents; binder stones reset 27 cents, range 19 to 70 cents.

The parts of streets constructed were all short, ranging in length from 30 feet to 1,336 feet, but 6 of the 77 contracts covering more than 900 feet of street.

The city reconstructed 22,292.1 linear feet of streets, of which 13,466.7 feet were asphalt, costing 95 cents per square yard, not including concrete base; 3,373.1 were brick, costing $1.60 a square yard; 578 feet were asphalt macadam, costing 75 granite block pavement, using its own force, at a cost of $1.54 a square yard; 432 feet of brick street for $1.96 a square yard, and 606 feet of asphalt street at $1.38 a square yard.

Contracts for asphalt streets were distributed among the following contractors: Henry Bickel Company, Louisville Asphalt Company, Barber Asphalt Company, American Standard Asphalt Company. Brick street contractors were G. W. Gosnell, L. W. Hancock Company, L. R. Figg Company, Jefferson Construction Company and F. G. Breslen. D. R. Lyman is city engineer and E. B. Schmidt is assistant city engineer.



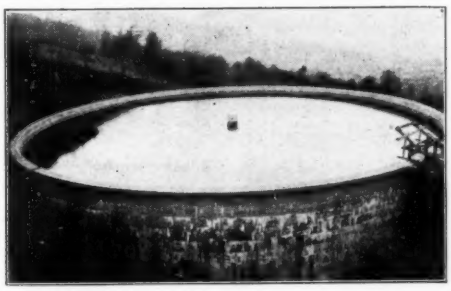
Asphalt pavement on Wellington Street, Memphis, Tenn. Laid by Memphis Asphalt & Paving Co. in 1903.

FIVE-MILLION GALLON RESERVOIR.

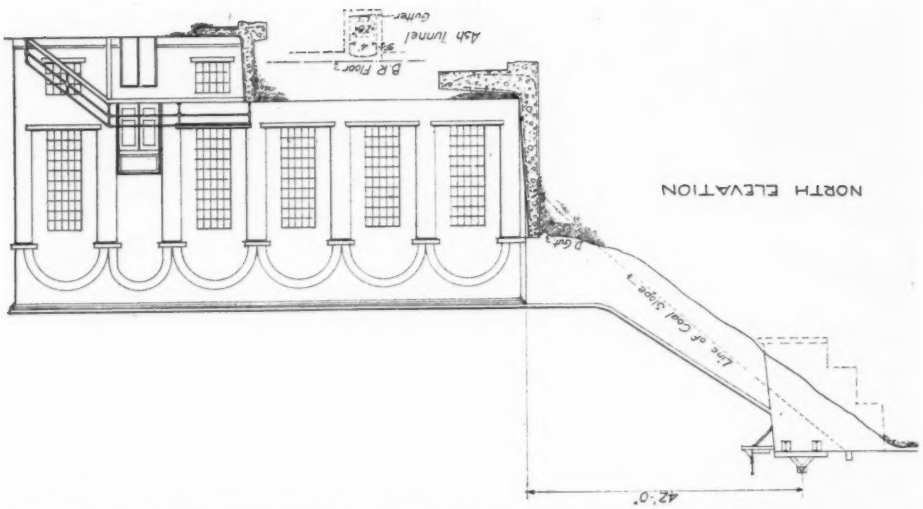
By Frank C. Perkins.

THE construction of a large reinforced concrete reservoir built to insure an auxiliary or emergency supply for the water system of Asheville, N. C., may be seen in the accompanying illustration. It has a capacity for 5,000,000 gallons of water and measures 150 feet in diameter at the bottom and is 40 feet deep. The wall is 3½ feet thick at the bottom and tapers to a thickness of 8 inches at the top. The reservoir holds a quantity of water sufficient to last the city three or four days, during which could be repaired any breaks in the pipe line, nearly 20 miles long, to the intake in the mountain from which Asheville is directly supplied with water.

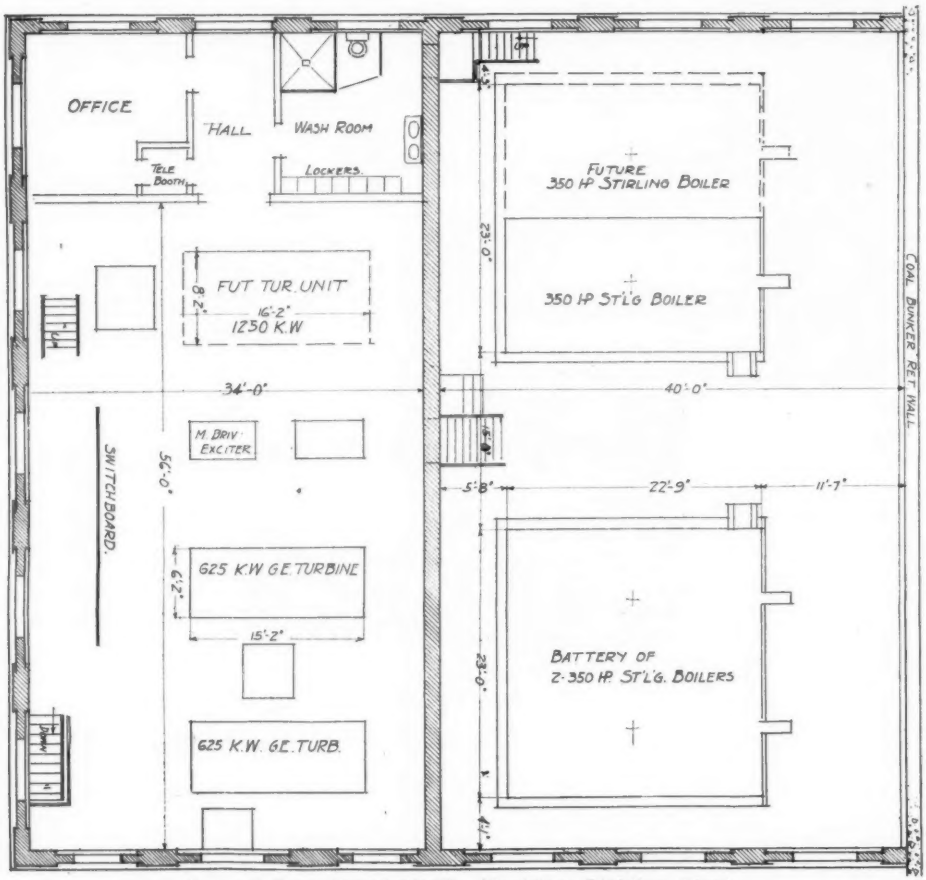
It has been stated that as first constructed the reservoir was not satisfactory, but was reconstructed and given a thorough test, the work being done by Geo. H. Davidson, of Asheville, who laid an entire new floor 8 inches thick, using 900 barrels of Lehigh portland cement, 20 tons of ½-inch reinforcing steel, 500 yards of 1-inch broken stone and 3 tons of Trus-Con water proofing composition. This work cost $11,000, bringing the total cost of the reservoir to about $47,000.



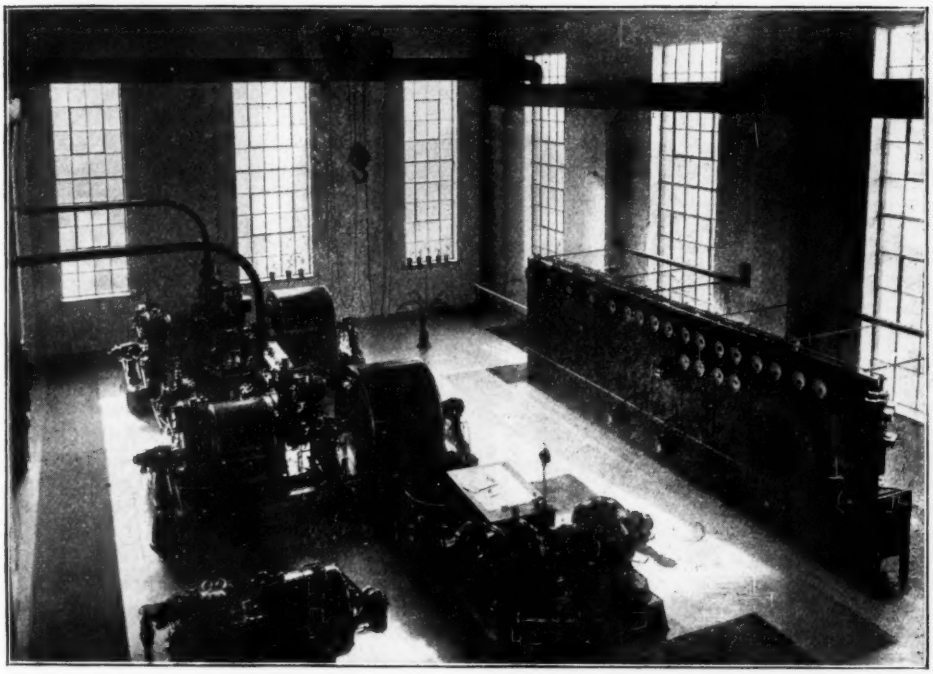
Concrete Water Tank at Asheville, N. C., of 50,000 Gallons Capacity



Elevation Crawfordsville Municipal Lighting Plant, Showing Advantage Taken of Natural Conditions.



General Plan Crawfordsville Municipal Lighting Plant.



Turbin Room Crawfordsville Municipal Lighting Plant.

A Successful Municipal Lighting Plant.

After twelve years of unsuccessful operation of its municipal lighting plant, the city of Crawfordsville, Ind., was finally awakened to the fact that its plant had very great possibilities for successful operation if divorced from politics and placed in the hands of an efficient governing board. This step was finally taken in 1903, the result being that today the city owns an efficient plant, a large portion of which has been paid for out of the earnings, as a result of efficient management.

On August 21, 1891, the original plant was put in operation and it ran from that date until July 3, 1911, lacking but a few days of twenty years of operation. Until 1903 the plant was in charge of a committee of the council. This committee then appointed a superintendent, who followed the dictation of the council committee. This system was naturally a means of fulfilling political indebtedness. The superintendent and employes were changed frequently and in but rare cases was any degree of efficiency secured. After many years of deplorably loose and inefficient management the machinery and transmission system became so utterly depreciated that the system was nearly worthless and the office organization, accounting methods and business management had assumed a chaotic condition which it was almost hopeless to attempt to untangle.

The Reorganization

In the year ending 1902 the plant showed an expense of operation two and one-half times in excess of receipts. The entire equipment was out of date and in poor repair. At this juncture the people demanded a reorganization and secured it in 1903. The old committee, composed of

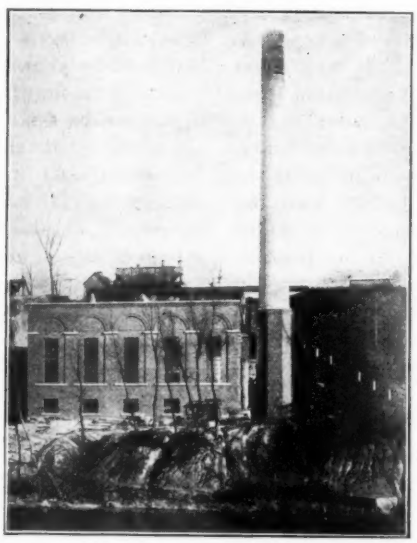
councilmen, was abolished and in its place a board was composed of three members, who were elected by the council, each member serving 3 years, and one new appointment being made each year. This board has been in charge continuously since 1903 and it has complete control of the plant. The present board has been in office 6 years, with a change of but one member, caused by death. This board is now composed of the following: President, M. W. Bruner, prominent lawyer; secretary, G. B. Luckett, manager of the Crawfordsville Shale Brick Company; treasurer, G. F. Huggans, retired engineering contractor.

J. R. Thomas, General Manager Crawfordsville Electric Light & Power Co.

The New Superintendent

The trustees, appreciating the difficulties of attempting to rehabilitate the old plant in a manner that would place it on the efficient basis desired, employed J. R. Thomas to take charge, who is a graduate of Purdue University. He seemed better able to cope with the difficult conditions encountered than any one else. His intimate knowledge of all details, his idea of what an efficient plant should be, coupled with a high degree of engineering ability, made his services of great value. In September 1903 he was placed in charge. Mr. Thomas put the old plant in the best repair possible and advisable. However, he fully appreciated the ineffectiveness of working with worn out and antiquated equipment. He, therefore, set about making plans for a new plant that would embody the very latest practice, and contain as highly efficient equipment as possible to secure. The plans made by him were carefully considered by the trustees, together with his report of conditions as he found them at the old plant, and it was determined to secure the services of the Esterline Company, Lafayette, Ind., to work out the further details for a model plant and equipment. The building committee was composed of the board of trustees and one member of the City Council, Henry Meister.

A site was selected, with several important features in mind, such as an adequate supply of water at all times, a means of handling coal and ashes that would reduce the cost to a minimum and a location that could be beautified so as to form the nucleus for a park system. The city at present does not have a public park or municipally owned civic beauty center. The latter features will be very effectively accomplished when the comprehensive plan formulated is carried out.

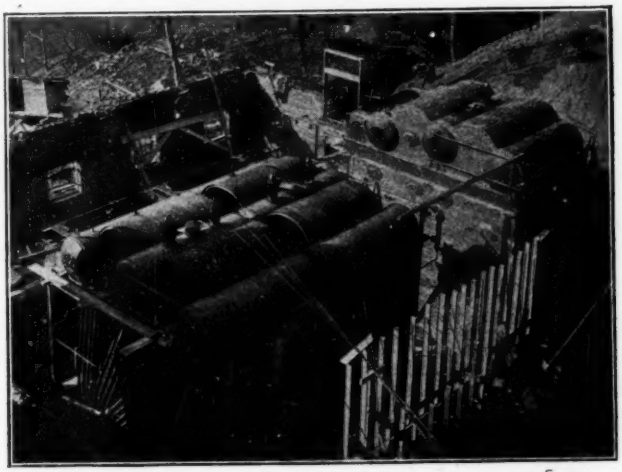


Exterior View of Plant—Note Car Unloading Coal on the Bluff.

The New Plant

The plant is located at the foot of a high bluff and on the east bank of Sugar Creek, about three-eighths of a mile from the center of the city. On the ridge of the bluff is a switch of the Monon Railroad, over which all coal is received. The station proper is located on

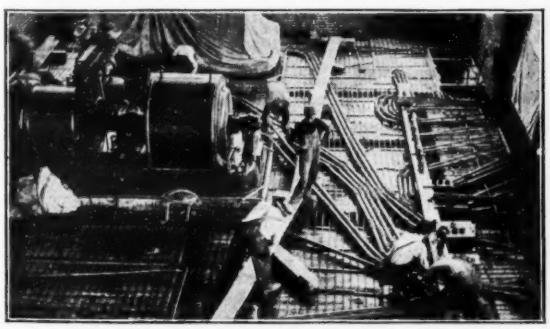
a natural ledge 65 feet below the railroad track and 20 feet above the creek. The building is of concrete, brick and steel; its plan being almost square, 71x75 feet. The boiler room occupies a space 71x40 feet and the engine room 54x34 feet. The main floor space at the end of the turbine room is divided into an engineer's office, telephone booth, shower bath, lavatories, etc. Above these rooms is a plant laboratory for carrying out tests upon the equipment. The building was designed to enable the turbine capacity to be doubled, and the boiler capacity to be increased 33 1-3 per cent, without the necessity of remodeling the plant. The excavation and concrete work was done by W. C. Carr & Son on a percentage basis. The building was also constructed by them, on contract.



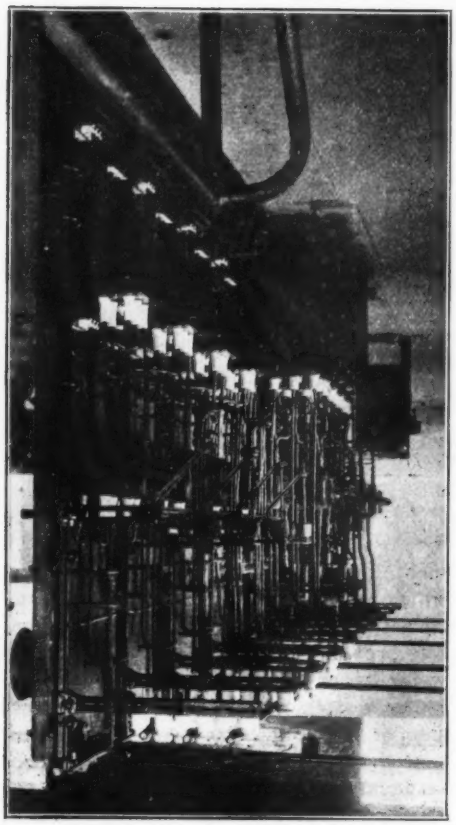
Construction View Showing Setting of Boilers.

In the turbine room are situated the two 25-kw. exciters, one of which is a Curtis turbine-driven generator of 3,600 r. p. m. and the other an induction motor-driven generator; two electric units of 625 k. v. a. 2,300 volt, 60 cycle, 3-phase, driven by Curtis horizontal turbines. This equipment was installed by the Ft. Wayne Electric Company. Space has been allowed for future installation of an additional 1,250-kw. turbine unit. All of the bearings of the turbines are water cooled. Turbines exhaust thru 24-inch lines into Alberger jet condensers, which are located in pits in the basement beneath the turbine room. These condensers provide 28-inch vacuum when cooling water is at 70 degrees Fahr.

The switchboard, located on the west side of the room, has been very advantageously set, four feet of clear space being allowed between the wall and the wiring, etc., thus giving ample working room. This board controls the entire electrical output and is composed of 13 panels, one of which is a swinging panel. There are 2 generator panels, 2 exciter panels, 2 feeder panels, 1 arc feeder panel, 4 rectifier panels, which are equipped for controlling four 50-lamp Westinghouse 4-amp. metallic-flame rectifiers which are located in the basement, a special feature of which enables the tubes to be operated from the switchboard; and 1 Terril voltage regulator. Aside from this equipment, the board is equipped with watt meters, ammeters, volt meters, etc., and is provided also with a synchroscope, a frequency meter and watt hour meters, for registering the consumption on arc and commercial circuits. The switchboard and eqiupment were manufactured and furnished by the Westinghouse Electric and Manufacturing Company.



Construction View Showing Floor Reinforcement, Conduits and Wiring for Turbine Room.

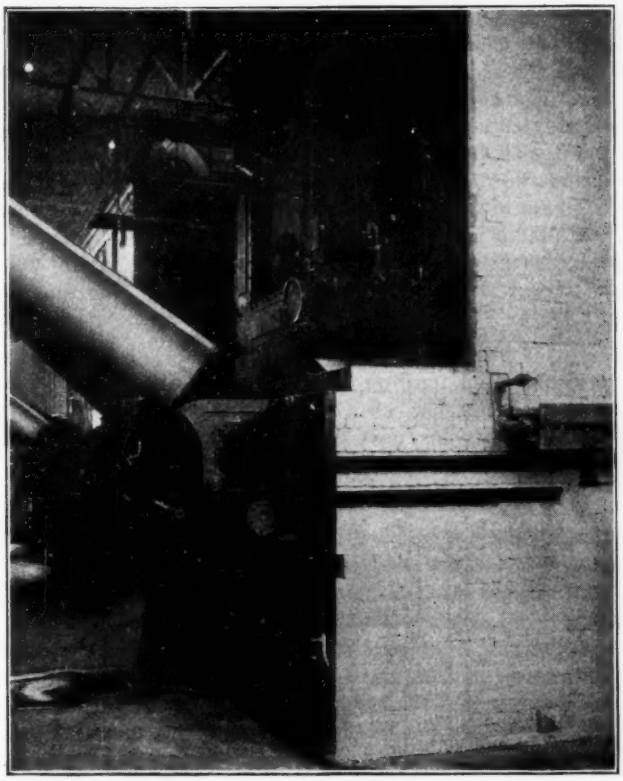


Switchboard in Turbine Room on which is mounted complete equipment for controlling all circuits.

The boiler room equipment consists of three 350-h. p. Stirling water tube boilers, which are fired by Roney automatic stokers. The flue gases are conducted thru a 150-foot Kellogg stack, constructed of red shale brick to the roof line of the building and thence of a radial buff brick. Internal diameter of stack is 7 feet. Provision has been made in the boiler room for an additional 350-h. p. unit. The boilers operate at 175 pounds pressure per square inch thru a 7-inch line to the main 10-inch steam header, which runs parallel with the partition wall between the boiler room and turbine room. From this header two 4½-inch steam lines supply the turbines. Extension hand wheels permit the operation of all steam valves from the floor level. Piping and valves are so arranged that any turbine can be operated from any boiler, regardless of the failure of any particular boiler unit. Water for the boilers is taken from Sugar Creek thru a 4½x3-foot concrete intake tunnel. The water is taken in thru a screen house of concrete, the wing walls of which batter in toward the bank. This construction causes a swift and deflected current which carries rubbish away from the intake rather than toward it. The intake is protected by three screens of 1-inch, ½-inch and ¼-inch, which thoroly remove all floating particles. The discharge tunnel is superimposed over the intake tunnel. In it a 3-foot baffle wall has been built which converts a portion of the tunnel into a hot well. From this well the steam-driven service pumps take their supply and deliver same to a supply tank in the boiler room over the feed water heater, from which the water flows by gravity. The final discharge of exhausted water takes place at a point in the creek about 200 feet below the intake. Just below this final discharge point is a low natural dam, which forms a pond stretching back a quarter of a mile from the intake. The water thus impounded assures an adequate supply, even during the driest periods and would serve as a cooling basin.

On the east side of the boiler house, extending up a 45-degree slope, are the concrete coal bunkers, which are 75 feet in width by 90 feet in length. Coal is supplied from dump-bottom cars, which are run in over a trestle spur at the top of the bluff, 65 feet above the floor. The coal slides by gravity to 12-inch openings and thence into the coal shutes and stokers. The floor of the bunker is a continuous 8-inch reinforced concrete slab carried on stepped pedestals which are seated on horizontal bearing surfaces in the bluff. Provision has been made for the future installation of a motor-driven coal crusher. The increase in price of slack coal and the very frequent shortage of it in this territory will make it practically imperative that such installation be made at some time in the near future in order that the plant may handle mine-run coal, if necessary, and not be dependent upon any particular size. Furthermore, if the station is forced to purchase mine run in place of slack during a time of coal shortage the crusher will effect a saving well worth while even

with the addtional expense of crushing. The capacity of the coal bunkers is 600 tons. A roof will be constructed over them in the near future. The installation of an automatic coal weigher is contemplated, to be located at the present coal opening of the bunkers.



Boiler Room, Automatic Stokers and Front End of Boilers.

Results With the New Plant

The ash pit, located beneath the boilers, is 4 feet wide by 6 feet high. In the floor of this tunnel is a narrow-gage track. Ashes are dumped from the ash pit directly into the car on the track thru 18x24-inch chutes and swinging doors located on the east wall of the tunnel. The car is then run over a narrow-gage track, to various low points surrounding the plant which it is desired to fill in, being hauled out by a cable wound on a drum driven from a 3-h. p. motor. Figures for the last year show that in the handling of 6,150 tons of coal and the subsequent ashes, by means of the gravity coal bunkers and the method of handling ashes just described, there has been effected a saving of $975.

At present, one laborer handles a 24-hour load of ashes in one hour. This saving represents a return on the investment in gravity coal bunkers and ash handling apparatus of about 20 per cent annually.

The mechanical equipment of the plant is maintained in a highly efficient manner by its chief engineer, J. E. Shelley, who has been in charge for the past six years. The other employes at the plant are a night engineer, a day fireman and a night fireman, and one plant attendant.

It might be noted here that the coal consumption for last year is rather misleading, when compared with the number of kw. generated, on account of necessity of running non-condensing while installing the screen house, which took considerable time on account of high water in the creek, and also on account of the day load being small for a majority of the year.

All transmission wires leave the plant underground, coming to the surface at a point 100 feet from the plant. The current is transmitted from the plant over a No. 2 wire, and service wires in no case are less than No. 6. All wire in the overhead construction is O. K. triple braid weather proof. Manufacturers a mile and a quarter from the station are supplied with power over a No. 6 wire. The total current generated during 1912 at the plant was 1,046,432 kw. The total meter consumption for the same period was 814,321 kw. The transmission efficiency was, therefore, 77.8 per cent.

The arc lighting system is compcsed of

200 Westinghouse metallic-flame 4-amp. series arc lights. All wiring is overhead. The city pays the trustees a fixed amount per lamp per year on a contract, as would be done in event the lighting plant were a privately owned company. The charge for lighting is $66 per arc lamp per year. An interesting fact in regard to the number of lights in Crawfordsville is that this city maintains more arc lights for street lighting purposes per capita than any other city in Indiana with a population from 9,000 to 20,000.

The New Reduced Rates

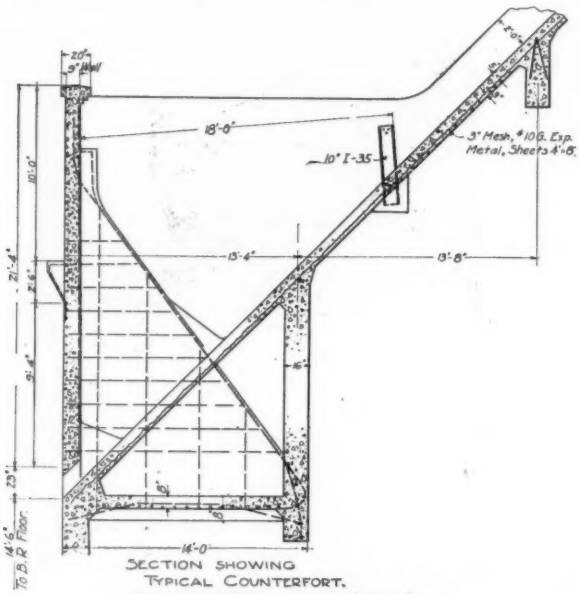
The commercial lighting rates at present are 10 cents per kw. hr. for first 100 kw.; 6 cents for next 200 kw. and for all over 300 kw., 4 cents. Consumers are allowed a 10 per cent discount on their bills when paid before the 10th of the month. This commercial lighting rate applies to every class of consumers using lights, whether for residential, church or factory lighting purposes.

The rates for power as as follows:

First 100 kw	4	cents
Next 400 kw	3½	cents
Next 500 kw	3	cents
Next 1,000 kw	2½	cents
Next 5,000 kw	2	cents
Next 5,000 kw	1¾	cents
Next 10,000 kw	1½	cents
Next 10,000 kw	1	cent

Where residential consumers install heating devices, such as stoves, heaters, etc., and current consumption is sufficient to warrant separate meter, they are allowed power rates. Power rates also apply on signs and building outlines. In addition to the above rates a "readiness-to-serve" charge is made as follows: 50 cents per h. p. up to and including 10 h. p.; all over 10 h. p., 25 cents per h. p. per month. This is a fixed charge against the consumer, whether any current is used or not.

The above rates were put into effect September 1, 1911. As compared with the rates prior to this date in the case of small consumers this was a reduction of 44 per cent and in the case of the largest consumers was a reduction of 20 per cent. The lowering of the rates at this time was found practical because of the large savings effected by the new plant, which started operation the same year. This reduction is the first step on the part of the management to furnish consumers with power at as low cost as possible, after making all necessary charges.



Sectional View of Coal Bunker.

The Results of Last Year's Operation

At the time the trustees took up the management of the plant in 1903 there were 430 consumers on the books. The

total revenue during the year 1902 was $8,351.91, the total expense for the same year was $20,801.51, not including merchandise. At the close of the year 1912 there were 1,378 consumers; the total revenue for that year was $50,578.53, not including merchandise. The total operating cost during the same period was $26,084.33, consisting of the following items:

Pay roll	$13,263.14
Coal and oil	8,475.60
Repairs on line plant, etc	1,025.33
Carbons	72.92
Insurance	135.20
Other operating expenses	3,112.34
Total	$26,084.53

In addition to above there were disbursements for year ending December 31, 1912, for improvements, bonds, interest, etc., $21,902.97; total disbursements, not including merchandise, $47,987.50; cash on hand December 31, 1912, $2,591.03; total, $50,578.53.

The Profits Thus Far

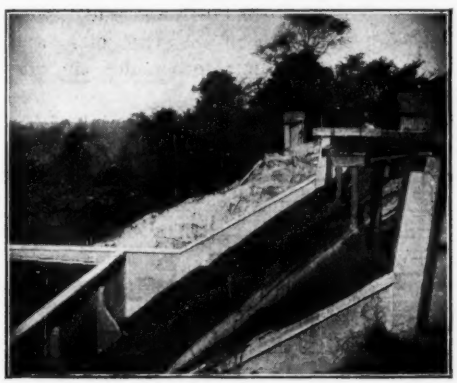
Prior to the action of the council in voting definitely upon appropriation for the new plant, the trustees agreed to furnish $35,000 of the amount necessary to finance the proposed plant. This sum was made up of a sinking fund containing $25,000, which had been established thru the successful management of the old plant; $10,000 then in a surplus fund also secured thru successful management and in the hands of the trustees. The council agreed to the raising of $73,000 by a bond issue. The appropriation for the new plant was, therefore, set at $108,000. When the new plant was completed the actual cost reached $119,342.28. Instead of paying $35,000 as originally proposed by the trustees, they actually paid out $52,924.30. Of this last amount $6,582.02 was paid to the city for the retirement of bonds. Therefore, the remaining bonded indebtedness to be met by the lighting plant from its profits is $66,417.98.

Mr. Thomas is now working out a schedule of depreciation charges that will amply cover actual depreciation due to natural wear and tear, and also of all equipment and depreciation due to progress, as well as creating a fund for extension and improvements. This burden will be charged against the plant in the very near future, and rates will not be further lowered until such time as it is demonstrated beyond all question of doubt that the plant is capable of earnings in excess of every necessary charge to keep it at a maximum of efficiency and in a thoroly modern condition.

The People Are Satisfied

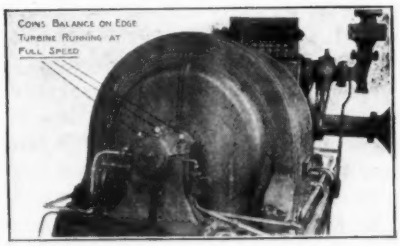
That the people of Crawfordsville are thoroly satisfied with the service they are receiving is demonstrated on every side. Not only are they loud in their praises of the service they are receiving, both as to cost and quality, but they have further demonstrated their approval by their support. The average annual increase in number of consumers since 1903, when the board of trustees took charge, has been 22 per cent. The average yearly increase in population for this city for the ten years prior to 1910 was 4½ per cent. The revenue from power has increased over 100 per cent for the period from January, 1911, to January, 1912. The increase in revenue from commercial

Coal Bunkers under construction.



Coal Bunkers after completion.

Skidding Turbines from Railroad to Plant.



Curtis General Electric Turbine.

lighting for 1912 over 1911 was over 7 per cent, notwithstanding the reduction in rates of from 20 to 44 per cent in the same year.

Non-Political Municipal Ownership a Success

The figures and description presented here show quite emphatically that a municipally owned plant, under the direction of a competent executive board, which has been removed from politics as far as possible, and placed in the hands of a thoroly competent general manager, similar to those employed by privately owned public utility companies, a degree of success can be secured that compares very favorably with that of private public utilities. The matter of rates is vested in representatives of the taxpayers and if these representatives do not have political "axes to grind," and are assured of a continuance of office based upon an efficient conduct of the affairs placed in their hands, the people are then practically guaranteed a protection of their interests, rates that are fair and equitable, and the right of appeal and hearings as taxpayers, without the barriers that franchise grants impose upon them.

INCREASED DRAINAGE CANAL DIVERSION REFUSED.

The application of the Chicago Sanitary district to divert 10,000 cubic feet of water per second instead of the 4,167 cubic feet now authorized has been denied by Secretary of War Stimson. This will interfere very seriously with the plans of the sanitary district for the drainage and sewerage of large areas in the city and the southern districts into which the city is rapidly extending.

The reasons given for the denial of the petition are given as follows:

That the diversion of 10,000 cubic feet per second from Lake Michigan, as applied for in this petition, would substantially interfere with the navigable capacity of the navigable waters in the Great Lakes and their connecting rivers.

That being so, it would not be appropriate, without express congressional sanction, to permit such a diversion, however clearly demanded by the local interests of the sanitation of Chicago.

That on the facts here presented no such case of local permanent necessity is made evident.

That the provisions of the Canadian treaty for a settlement by joint commission of "questions or matters of difference" between the United States and Canada offer a further reason why no administrative officer should authorize a further diversion of water, manifestly so injurious to Canada, against Canadian protest.

Chicago will, doubtless, make strenuous efforts to secure a reversal of this decision, for, otherwise, the city must prepare to purify the sewage of the new districts and some from older districts before discharging it into the lake, the streams flowing into the lake or the drainage canal itself.

PARK DRIVES AND BOULEVARDS.

By Linn White Chief Engineer, South Park Commissioners, Chicago, Ill.

Park driveways in this article are taken to include all public routes of travel on which the character of traffic is restricted, and are thus distinguished from streets and highways on which traffic of all kinds moves unrestricted. The term includes what are, in many cities, called boulevards, which may be parts of a system of streets through populous districts of a city, or may partake of the nature of a suburban highway.

Usually what is termed heavy traffic or teaming traffic is excluded from roads of this character. This establishes a class of fast moving, generally light vehicles traveling over boulevards and park driveways and limits the character of surfaces to those best adapted to this kind of traffic. The surface of such roads must be smooth, but not slippery; firm, but not hard; stable, but with a measure of rubber resiliency; should withstand a wide range of temperature variation without injury; be free from dust; easily cleaned and without an unpleasant glare in sunlight. Also the roadway must be of ample width, the crown not too high, drainage carefully provided and catch basins or sewer inlets placed at frequent intervals.

The character of traffic over such roads is of the highest class in the community and the standard of road excellence is continually being made higher. On a road thru a park, formality should generally be dispensed with. Grades should be laid to cling close to the surface of the ground, the alignment should be with easy, natural curvature, not forced and meaningless, but leading with fair directness to the objective point.

Intense Traffic in Chicago

In the improvement of boulevards and city park driveways, the amount as well as character of traffic should determine the kind of paving surface. The words commonly used to describe traffic are "light" and "heavy," but the terms are ambiguous as *light* may mean light weight vehicles or few in number; *heavy* may mean heavily loaded of great in numbers. The use of such terms as "intense" should better describe a condition of traffic that exists on many park roads than either "light" or "heavy," meaning a great many comparatively light weight rapidly moving vehicles. Such a condition is found on the Chicago boulevards and it is rapidly growing more intense.

A bituminous pavement has more of the desirable qualities for a boulevard or park road pavement, but unless properly

Cross Sections.
No. 1. *No. 2.* *No. 3.*

constructed in all respects may prove a disappointment under intense traffic. If the pavement is lacking in lateral stability under high temperature or is not properly supported by the base the effect of rapidly moving vehicles is to form parallel grooves or ruts which when once started grow worse, because each following vehicle tracks in the same rut the preceding one started.

Asphaltic Pavement

Many of the boulevards and park roads of the South Park district during the last three years have been laid with what is termed mineral rubber pavement. This is a pavement that has become fairly well known in many sections of the country by frequent descriptions and because of its acknowledged success and low cost. The mortar is similar in composition and proportions to a sheet asphalt surface mixture. The proportions of broken stone in the mixture may be varied according to circumstances. When it fills a very considerable proportion of the mass, it aids in making a stable, non-shifting surface. The base should have a rough surface, not completely filled with fine materials, so that it will completely interlock itself with the top surface. This is best done on macadam by light rolling and on concrete by tamping, while, in both cases, the foundation is still soft.

Cross Section Views

The illustration shows sections of this pavement which have been under traffic and which have been sawn thru to show the structure.

Section No. 1 is a scant inch thick and has been under traffic for four years with no repairs. This section was lifted from a block on Grand boulevard, also shown in this article, one of the first boulevards laid with this paving in Chicago. It has been subjected to intense traffic during the past four years and it behavior has been exceedingly exemplary since, as before stated, it has not required repairs of any kind and to date has not shown the slightest defect or sign of movement. Section No. 2 is about 1 inch thick and has a number of stones of the base adhering, which were lifted with it and sawed thru to illustrate the complete structure. All of these samples were photographed with the wearing surface down. In order to illustrate the intense traffic to which Section No. 1 has been subjected, I quote from our report of April 10, 1911, and it is but fair to state that the traffic at these two points on

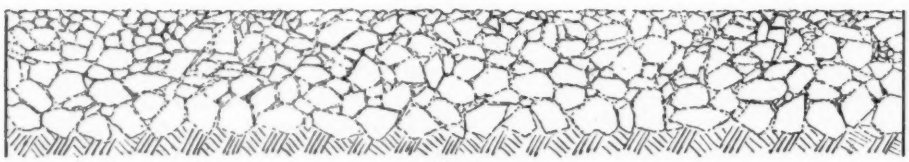


Fig. 1.

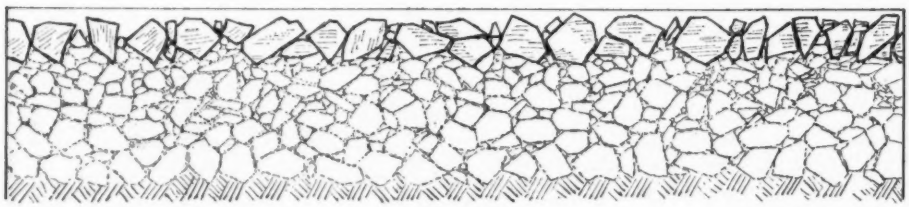


Fig. 2.

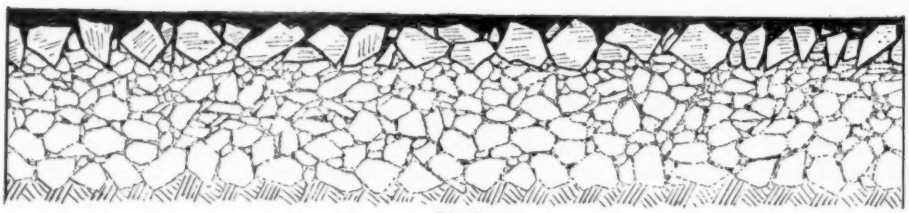


Fig. 3.

Fig. 1. First Course, Macadam Base.
Fig. 2. Second Course, Layer of Coarse Stone.
Fig. 3. Third Course, Mixed Bituminous Wearing Surface Rolled Into Intermediate Layer of Coarse Stone, Forming the Complete Pavement.

Grand boulevard has increased fully 33 1-3 per cent during 1912:

Location	Date	6 P. M. to 6 A. M. Automobiles	Horse Vehicles	M. Cycle, etc.	6 A. M. to 6 P. M. Automobiles	Horse Vehicles	M. Cycle, etc.
Grand Boul. and 38th Street	3-13-11	1156	120	78	2311	221	216
Grand Boul. and 51st Street	3-14-11	1078	58	109	1320	118	178

	Greatest Number in One Hour				
	Automobiles	Horse Vehicles	M. Cycles, etc.	Total All Kinds	Total for 24 hours
Grand Boul. and 38th Street	5 to 6 P. M. 260	2 to 3 P. M. 50	12 to 1 P. M. 42	384	4102-2
Grand Boul. and 51st Street	8 to 9 P. M. 251	3 to 4 P. M. 24	5 to 6 P. M. 34	282	2861-9

Our experience has shown that this style of pavement fills the requirements of Chicago's intense traffic streets and that it is moderate in cost, easy to repair and thoroly waterproof. It has a smooth, sanitary surface of an agreeable dark color free from glare and is of uniform consistency under a wide range of temperature. It is elastic in that should the foundation prove somewhat weak, it can be depended upon to adjust itself to the conditions, always remaining an elastic, non-slipping, non-absorbent, non-dust and non-noise producing pavement.

The Asphaltic Mixing Plant

We have adopted Twentieth Century portable asphalt plants for producing these pavements. They are complete asphalt plants mounted on one truck and which may be moved over an ordinary road without dismantling in any respect. To move the plant is it only necessary to throw the belt off the driving pulley and attach a roller or traction engine. In these plants the heating and drying of the stone and sand is done by forced draft, the asphalt is heated by the same fire that heats the sand, and the mixing is done in a regular type of asphalt mixer not exposed to the direct heat of the fire. The daily capacity of each of these plants is rated at 1,000 square yards of pavement 2 inches thick, but the record is that frequently 1,250 square yards or more 2 inches thick, and 1,700 square yards 1½ inches thick have been laid with each plant. Four of these plants are in use in the Chicago park systems and about a million and a quarter square yards of pavement have been laid with them during the last four years.

Grading and Rolling Crushed Stone.

Asphalt Plant in Operation.

Plant Foreman's Report

Our method of recording costs and results of daily work of asphalt plant crews may be of interest. The daily report of the asphalt plant foreman, records:

1. Date.
2. Work number.
3. Location of work.
4. Total batches delivered by each asphalt plant.
5. Hours delay and cause.
6. Number and duties of each man employed.
7. Number of hours and rate per hour of each man.
8. Amount of asphalt used.
9. Amount and kinds of stone used.
10. Amount and kinds of sand used.
11. Amount of coal used.
12. Amount of gasoline used.

In order to illustrate the data as to number, rate and hours of men employed in the asphalt plant crew, I quote from the asphalt plant foreman's report on work order No. 2201 of July 1, 1912, as follows:

Number of men.	How occupied.	Rate.	Hours.
1	General construction foreman	55 5/9	1
1	Asphalt plant foreman	33 1/3	9
1	Traction engineer	55 1/2	12
2	Firemen	29 2/3	18
4	Asphalt cutters	25	36
4	Tankmen	25	36
6	Feeders	25	54
4	Mixers	25	126
2	Coal men	25	18
6	Men cleaning up	21 7/8	54
4	Linemen	25	36
1	Oiler—Machine tender	30	12
4	Carts hauling hot asphalt	50	24
4	Carts moving material	50	12
1	Team cleaning up	68 3/4	9
1	Timekeeper	33 1/3	2
2	Timekeepers	27 1/8	4
2	Watchmen	25	18
1	Water boy	12 1/2	8

The Surface Crew

The surface foreman's report on work order No. 2201 of the same date records:

1. Date.
2. Work number.
3. Location of work.
4. Thickness of asphaltic concrete laid.
5. Square yards of each thickness.
6. Number and duties of each man employed.
7. Number of hours and rate per hour of each man.
8. Total batches received from each asphalt plant.
9. Number gallons for squeegee.
10. Number cubic yards and kind of sand.
11. Number pounds of coal.

The surface foreman's report on work order No. 2201 of the same date also records:

Placing and Rolling Wearing Surface.

Number of men.	How occupied.	Hours.	Rate.
1	Top foreman	40	9
4	Laborers raking	38	42
1	Laborer tamping back	38	10 1/2
2	Laborers tamping	32	21
4	Laborers spreading	27	42
1	Laborer dumping carts	27	11 1/2
1	Laborer painting joints	27	11 1/2
1	Laborer spreading sand	25	10
1	Timekeeper	27 1/2	2
2	Ten-ton rollers	55 1/2	21 1/2
1	General foreman	55 5/9	1

Square Yards Laid

The daily reports of the plant and surface foreman show at a glance the number of batches and square yards laid each day. The following information on work order No. 2201, July 1st to July 5th inclusive, is also obtained by speedy compilation from plant and surface foremen's reports:

Date.	No. batches Plant No. 1.	No. batches Plant No. 2.	Square yards 1½-in. asphaltic concrete laid.	Square yards 2-in. asphaltic concrete laid.	Hours' delay Plant No. 1.	Cause.	Hours' delay Plant No. 2.	Cause.
July 1-12	126	100	1453.1	70.3				Changing mix.
July 2-12	155	136	1858.6	....		Moving materials.	3	Moving materials
					2	Repairing grade.	4	Moving materials.
July 3-12	182	212	2417.4	....	1	Repairing grade.		Repairing grade.
July 5-12	161	165	1837.2	....	1	Moving plant.		

The Proper Setting

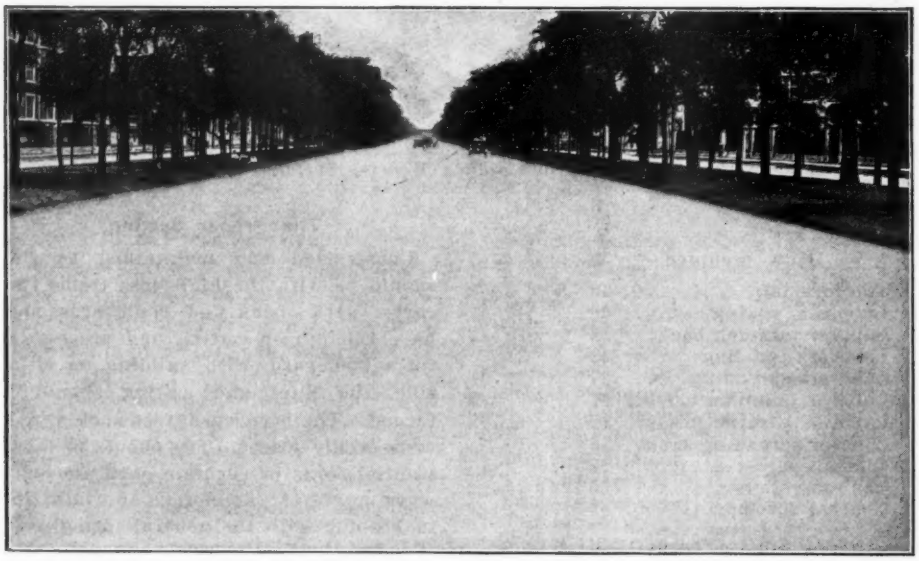
Constructed and maintained as they should be, with the high-class traffic they carry, park roads and boulevards must have the proper setting and accessories. On a boulevard, with building on either side, the lines and setting should be formal. The bordering trees should be in rows evenly spaced, there should be a substantial stone or concrete curb, the parkways on either side of regular width, and, in keeping with the general formality of the scheme, the alignment of the roadway should be straight, unless local conditions require curves.

If the contour of the land does not suggest or compel reasonable curvature, let the road wind around clumps of trees, as if avoiding the necessity of cutting them out, and mask the turns with clumps of shrubbery, as much as may be consistent

with safe driving, so there may be some variety and surprise in the landscape beyond. These matters may be encroaching somewhat upon the profession of landscape architecture, but an engineer to be entrusted with the planning or laying out of park roads must be somewhat of a landscape architect, or, to put it more accurately, he must be a lanscape engineer.

In park roads, using the term in its strict meaning, formal curbs should be dispensed with, catch basins should be generally of the sewer inlet type without settling basins, and castings for sewer inlet covers should be combination gutter grates and side inlets. This style of sewer casting is less conspicuous than the usual side inlet type with solid iron cover. The grating in the gutter may be lifted to give access to the basin and the side inlet provides an overflow in case the grating is choked with leaves. The lamp posts should be less obtrusive, less in evidence, than is permissible on boulevards. Their frequency will be according to necessity in each case, but generally lighting is not required to be as thoro as on boulevards.

A character and distinction is given the park road by judicious use of statuary and vases for flowers, as well as the proximity of walls, flights of steps and buildings. These are human touches of the roadside which give a pleasant sense of use and contrast with nature. Other roads that as in the old riddle "go up hill and down hill, yet always stand still," may satisfy the necessities only of transportation, but the park road should suggest time to enjoy surroundings. A seat well placed in a shady nook or a bridge over a quiet stretch of water is an invitation to linger awhile which is the proper function of a park roadside. Too many roadside statues, vases, balustrades, etc., suggest the architecture of formal gardening rather than the restrained naturalness proper in park landscape.



Asphaltic Pavement, Grand Boulevard, Chicago, Ill.

The latter two or three sentences are particularly applicable to what may be termed city parks with roads properly belonging to such semi-formal parks. There is another class of parks, often established near cities, belonging more to the free, open country where the roads must be simply improved to be in keeping with the rural character of other improvements.

There are, therefore, in the light of what has been said, three grades of park roads, which may be classed as boulevards, city park roads and suburban park

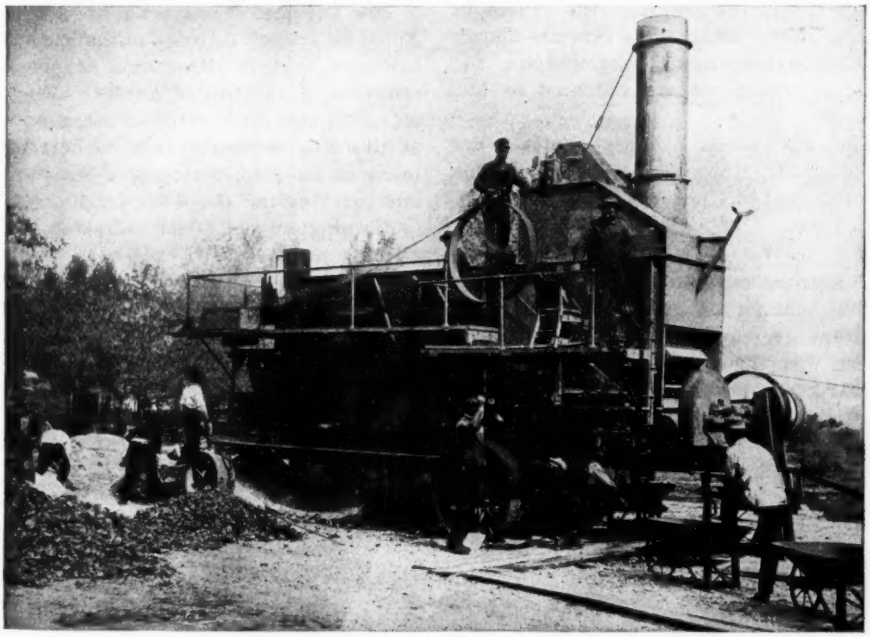
roads. Not every town or city interested in park development may recognize this exact division, but the natural tendency is towards it.

Summary of asphaltic concrete paving done by South Park commissioners with the portable asphaltic paving plants during the season of 1911:

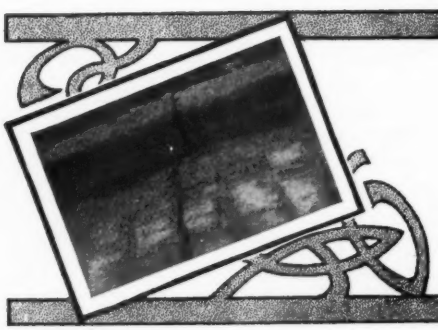
	Sq. Yds.
Jackson Boulevard	9,500
Michigan Avenue	19,045
Jackson Park, Harbor Drive	14,461
Grand Boulevard	21,280
Garfield Boulevard	28,428
Western Avenue	19,143
Washington Park, walks in vicinity of Administration Building	6,406
Washington Park, 57th St. driveway entrance	2,096
Drexel Boulevard	3,782
Hamilton Park, Tennis Courts	4,017
Repairing openings in pavements made under permits	3,046
Miscellaneous repairs and other small items charged to maintenance	2,551
Total for 1911	133,755

Summary of asphaltic concrete paving done by South Park commissioners with the portable asphaltic paving plants during the season of 1912:

	Sq. Yds.
Washington Park, East Drive	27,400
Drexel Boulevard	11,500
Jackson Park, Middle Drive	8,500
Michigan Avenue	7,825
Grand Boulevard	22,738
Garfield Boulevard	19,900
Sherman Park	4,863
Western Avenue	4,625
Miscellaneous repairs and other small items charged to maintenance (est.)	3,200
Repairing openings in pavements made under permits (est.)	2,500
Total for 1912	113,051



Portable Asphalt Plant Used by Park Commission.



PREVENTION OF DEFECTS IN BRICK PAVEMENTS.

THE careful study of the expansion and contraction of brick pavements made by James E. Howard of the United States Bureau of Standards, the methods of which were explained in an article in the December number of MUNICIPAL ENGINEERING, has shown the reasons for a number of the minor defects which develop in brick pavements, and has given suggestions of lines in which to direct the investigation of the causes of others. Some of these defects are shown in the accompanying photographs, for most of which we are indebted to Mr. Howard.

The discussions of these defects are based on Mr. Howard's expressions of his opinion, but do not always agree fully with them.

Transverse Cracks

The transverse cracks shown in Fig. 1 (in heading of article), appeared in Andrews avenue, Lakewood, O., before the street was thrown open to traffic. Mr. Howard reports a progressive development in these early transverse cracks from fine hair lines to widths even greater than that shown, and that they appear in pavements having the expansion joint next the curb, as well as in pavements like the one shown, in which there is no such longitudinal expansion joint. He attributes the crack in the pavement to the expansion and contraction of the curbstones, the friction of the stones on the brick causing the latter to follow. It is probable that this friction tends to locate the crack in the pavement in the joint nearest the joint in the curb, but the form and width of the crack shown in Fig. 1, as well as the cracks observed in other parts of the pavement, show that the brick pavement also expands and contracts without reference to the curb and that cracks in the pavement are generally independent. The transverse cracks shown in Fig. 2 are further evidence of this. This pavement, on East Sixty-sixth street in Cleveland, O., is older and the cracks are more pronounced.

Lengthening of Pavement

The pavement lengthens as a whole. Andrews avenue in ten months' time had extended in both directions, at one end crowding five-eighth of an inch over the marginal curb at a railroad crossing, and at the other crowding the asphalt pavement on the intersection of a cross street and carrying the street car tracks with it.

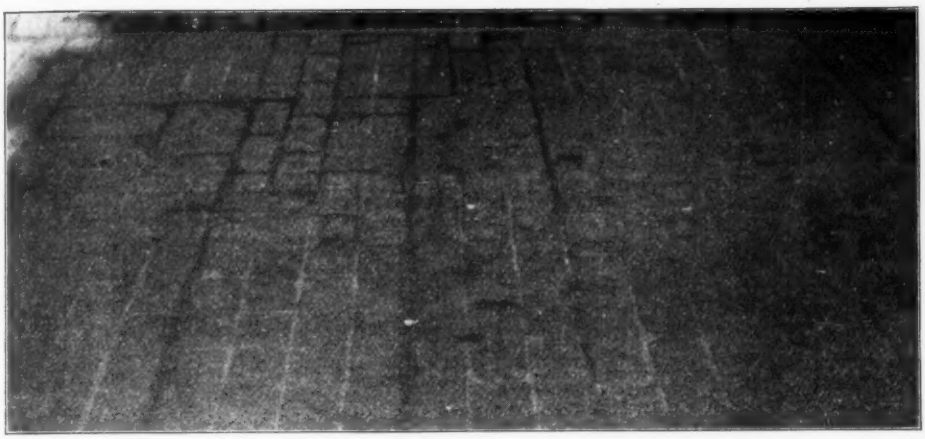
Farmington road, East Cleveland, paved about August 1, 1911, was observed during September, October and November and showed extension in the 20-inch length measured from September 22, to September 30, of 0.0080 inch; to October 23, of 0.0170 inch; to November 9, of 0.0250 inch, and to November 13, of 0.0377 inch. The temperature on September 22 was about 90 and on November 13 was 32 degrees. In August, 1912, with a temperature of 82 degrees, the crack was very much reduced in width.

Widening of Cracks

A cement filled brick street is intended to be a monolith with the adhesion of the cement to the brick as nearly equal in strength as possible to the cohesive strength of the bricks and of the cement in the joints. Cracks appear upon the contraction of a pavement on account of cold, because the bond between the cement in the joints and the brick is broken, or

because the cement joint has not attained its full strength. The opening of the joint increases with the decrease in temperature, the amount of the opening, as given above, being due to the contraction of the masses of brick on each side of the crack, which are still monolithic and so act as two units. The amount of opening at any one crack also depends upon the possibility of motion of the monolithic masses upon the sand cushion. One crack may not open because there is a tendency for the mass to remain fixed at that end, and the crack at the other end opens because the mass contracts away from it. Other things being equal the masses tend to contract toward their fixed centers and the openings of the cracks are proportional roughly to the drop in temperature.

Grade, resistance at ends of the stretch of pavement, even form of bearing of brick on sand cushion, give tendencies for greater motion in one direction than in another, so that creeping of pavements is frequently observed. Andrews avenue, as noted above, expanded in both directions. Belmore road, near Euclid avenue, East Cleveland, moved nearly 4 inches at the point shown in Fig. 3, shearing off the catch-basin grating. All engineers are familiar with examples of this sort.



2. *Transverse Cracks in East Sixty-sixth Street, Cleveland, after several years of development.*

Contraction Joints

If the pavement as laid is truly monolithic and a plane and remains so, and if it could be laid during a period of uniform temperature long enough to enable the mass to set completely, the monolith would have no temperature stresses in it. If, now,

3. *Catch basin grating, Belmore road, near Euclid Avenue, East Cleveland, O., sheared by creeping of pavement and moved nearly three inches.*

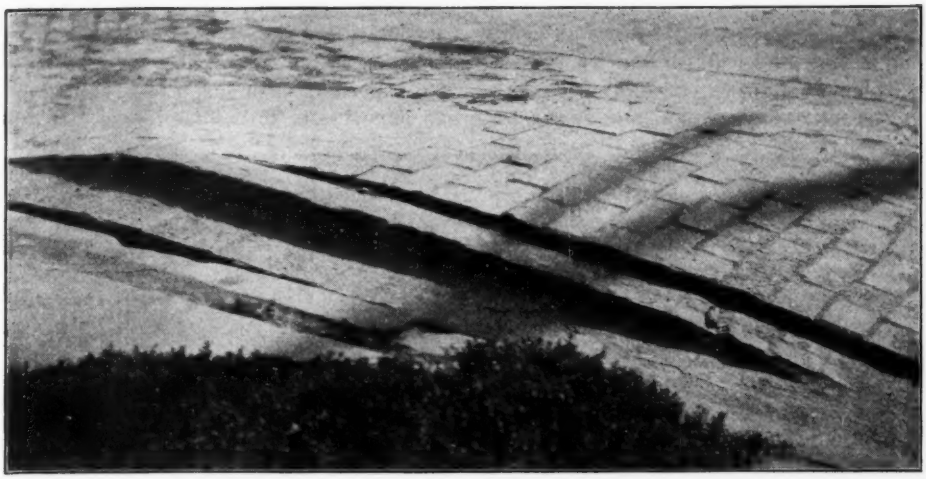
the temperature rises, an internal compressive stress is developed. If the pavement is a plane surface and the ends and sides are rigidly held, this stress increases with the temperature and with sufficient increase in heat might ultimately become great enough to crush the brick or the cement joints or cause the pavement to bulge in some place where the direction of the stress was changed by defective construction or material. The greater heat on the surface of the bricks causes greater stress in the upper part of the pavement and thus insures a tendency to bulge. The temperature stress is seldom, if ever, sufficient to crush the brick, unless the stress is concentrated on a single line, as was probably the case in the spalled joints next to the creosoted wood block "contraction joint" shown in Fig. 4, from East Thirty-second street, Cleveland, O. This wooden block course is not an expansion joint because the blocks do not permit sufficient compression to act as such, but are rather joints to locate transverse cracks due to contraction. The pavements in which they are used should be laid at high temperatures, or at least the wooden block should be inserted when the temperature is high. The difference in material presents a variation, the result of which it is difficult to predict. The wooden course does not confine the pavement rigidly and yet it does not permit it to expand. It does not wear uniformly with the brick and so presents an area of weakness. Its only value is in breaking the monolith into sections short enough to insure that contraction cracks will not occur between the wooden courses, thus locating all such cracks at predetermined places.

If the temperature falls below that at which the pavement was laid, the internal stress is one of tension and there is a tendency to pull the monolith apart. Defective filling of the joints with cement grout, or disturbance of the pavement by use or by considerable change in temperature before the cement has fully set will cause separation at the defective joints, but cement filler properly put in will withstand the ordinary reductions in temperature to which a brick pavement is subjected.

4. *Spalled Courses in East Thirty-second Street, Cleveland, O., adjacent to course of creosoted wood blocks, which may serve as a "contraction joint," but fails to allow expansion or to confine the pavement rigidly.*

Temperature to Lay a Pavement

It is evident that the proper temperature at which to lay a pavement is one somewhere near the mean of the ordinary extremes to which it is subject, say, 10 below zero and 130 above in the central latitude of the United States. Pavements laid in temperatures above this average will be subject to some troubles, which those laid at lower temperatures are free from, and the reverse. In any particular case the range in temperatures at time



5. *Upheaval of crowned sidewalk crossing on Ravine Avenue, Cleveland, O., by expansion of pavement each side of it.*

of laying is considerable and a reasonable variation above and below, say, 60 degrees must be expected.

If the ends of the pavement are not rigidly held, there will be the creeping already mentioned and shown. Street intersections will usually show the effect of this expansion, because there are changes in the surface due to the crowns of the intersecting streets. The expanding blocks of pavement on either side of the intersection will crowd these crowned areas and the result is the lift of the summit of the crown shown in Fig. 5, from Ravine avenue, Cleveland.

A Perfect Pavement

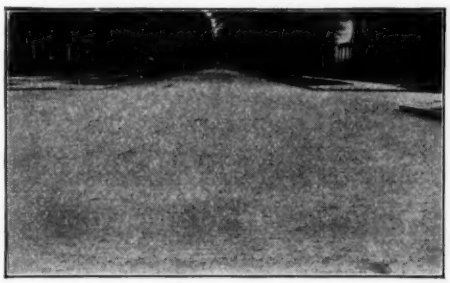
The perfect surface of South Sixth street, Terre Haute, Ind., Fig. 6, laid in 1891 and 1892, shows the advantage of perfect construction at average temperatures, but the street intersections were unable to withstand the expansion of the blocks between and they buckled and even exploded where the crowning of the cross streets gave an opportunity for upward movement under the horizontal pressure due to the expansion.

Cracks formed by the pulling apart of the bricks will catch the street dirt, and if the pavement under increase of temperature tends to close the cracks it cannot do so completely. This emphasizes the tendency to creep, and, therefore, increases the width of the cracks with each change of seasons.

Mr. Howard reports that one section of Kennedy avenue, Cleveland, was laid with a tar filler and a section at each end of it with cement filler. One of the cement-filled sections is traveling up hill toward the tar-filled section and is compressing the end of that section. The other cement-filled section is traveling down hill with the same result. The bricks of the tar-filled section act as individual units, however, so that this compression is taken up by the tar-filled joints and the compression shows for but a short distance. The amount in 20 inches of measured section was 0.1155 inches near one end and 0.1968 near the other, between September 29, 1911, and August 25, 1912.

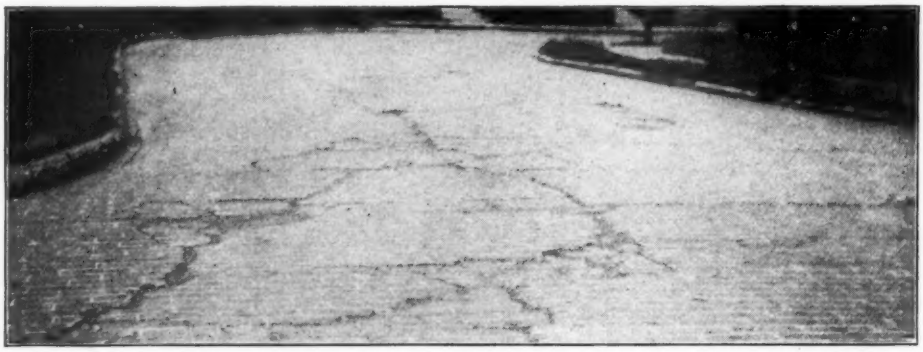
Effect of Curves in Street

The cracks shown in Fig. 7 in a reversed curve of Cummington road, East Cleveland, O., are due to the shearing



6. *South Sixth Street, Terre Haute, Ind., has a perfect surface after twenty-one years of wear.*

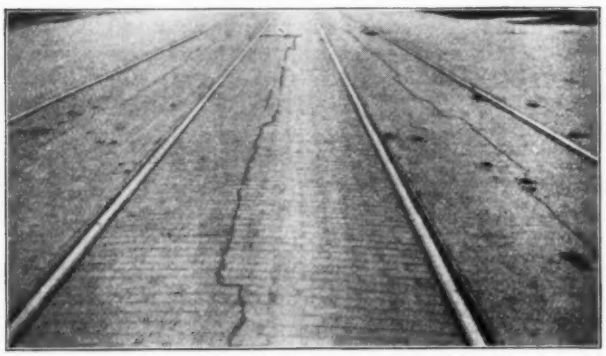
action of the straight stretches of pavement at each end, which have expanded and broken the bond of the brick where the change in crown curve positions gives opportunity for enough motion to pull them apart. The openings left between the pavement and the inner curb were 1½ and 2 inches. An opening between cement curb and gutter on the inside edge of a curve is produced by the pressure of the expansion separating the pavement from the gutter by the creeping of the former. The pavement is sometimes forced into the gutter on the outside of the curve enough to break curb and gutter.



7. *Fractures in pavement of Cummington Road, East Cleveland, O., on reversed curve, from expansion of straight pavement at each end.*

Longitudinal Cracks

There is a similar expansion of the brick pavement transversely. The ordinary street pavement has a crown so that the condition is changed from the straight-line effect of the longitudinal expansion and contraction. First, if the sides of the pavement are confined, expansion will tend to raise the pavement off the sand cushions, the arch having an opportunity to become longer. If this elevation of the crown of the arch is sufficient, a longitudinal crack occurs at or near the crown. Second, if the sides of the pavement are not confined, any creeping which may develop from alternate expansions and contractions will tend down the slopes of the crown toward the gutter and the strain set up in the pavement will result in a more or less regular longitudinal crack following the lines of least strength, with a tendency to remain near the crown of the arch. The cracks shown in Fig. 8 and 9 are of the nature of these two classes. Those in Fig. 8 are in West Fourteenth street, Cleveland, and have the appearance of bending under compression caused by expansion or settlement of rails under the weight of cars. That in Fig. 9 is in Kennedy avenue, Cleveland, and may be due to contraction. Another common cause for cracks in brick pavements in the more northern cities is bulging due to freezing of a wet sub-soil, but this should not be possible in a pavement with well-filled joints on proper foundation, drained by a sewer trench, as most paved city streets are.



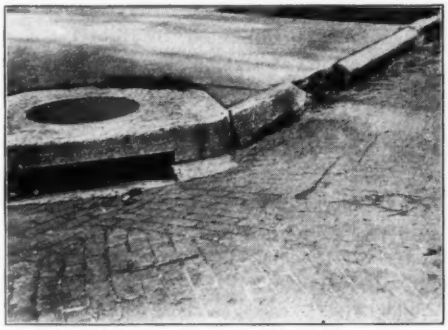
8. *Longitudinal cracks between rails and trolley tracks on West Fourteenth Street, Cleveland, O., due to transverse bending from expansion of pavement or expansion of rails.*

Fig. 10 shows other effects of transverse expansion. If the expansion joint next the curb is not wide enough or resilient enough, or there is none, as in the case of South Sixth street, Terre Haute, the transverse expansion of the brick pavement shoves the curb back and, when the curb is backed up by a sidewalk, the curb is pushed back under the sidewalk and broken off. Expansion of the sidewalk may aid in this process.

The heavy catch-basin construction at the corners held itself in position and the brick pavement itself was obliged to give way, some of the effects of which show in the picture. The effect was still greater out toward the center of the intersection, where excessive bulging took place and the pavement had to be relaid.

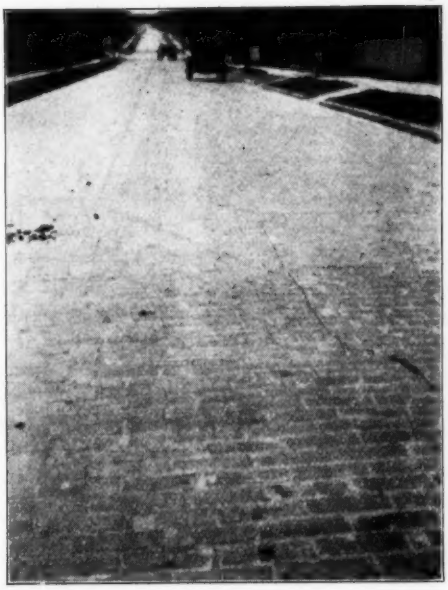
Expansion Joints

The specifications used in some cities call for expansion joints across the streets



10. *Breaking of curb on South Sixth Street, Terre Haute, Ind., by expansion of pavement. Heavier construction of catch basin keeps it in position.*

at each intersection and around the manholes and catchbasins. This is a concession to the change in form of surface due to the crowning of the cross street and does not deny the fact that a brick pavement laid at the mean or higher temperature is in more stable condition, will carry traffic better and will be less liable to cracks, spalling and crushing of joints, if it is rigidly confined at both ends. The same would be true of the sides of the pavement if it were a plane surface instead of curved. A condition of compressive stress is safer than one of tensile stress, because shocks upon the



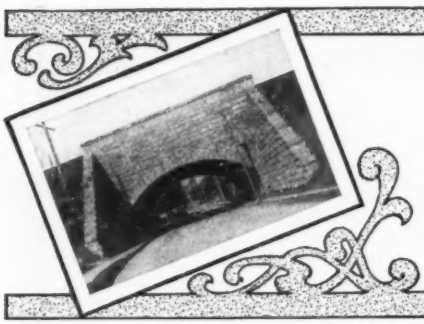
9. *Longitudinal Crack in Kennedy Avenue, Clevelond, O., probably due to expansion of pavement raising the crown.*

former can have little or no effect, whereas the factor of safety for tensile strength is less than that for compressive strength, and, therefore, a shock to a pavement under heavy tensile stress is more liable to result in a crack.

Transverse cracks in a pavement increase in width also by abrasion of the edges of the brick. Each solid section of pavement acts independently and any condition allowing motion, such as arching under compression, soft foundation, and the like, presents one edge of the crack or the other to direct blows of traffic, which are bound to knock off the unsupported edges and then to hammer the resultant lower surface until it is gradually or rapidly disintegrated.

Street Railway Tracks

The difficulties with street railway tracks are so well known that they need not be discussed here. In the early paving days they were accepted as a necessary evil and the first attempts at rigid construction under the tracks were resented as confiscatory expense. But experience has shown that the expense is fully justified in the saving of repair on the pavement surfaces.



AN ARTISTIC STONE ARCH.

By Henry B. Seamon, Member Brooklyn Engineers' Club.

WILE in the employ of the N. Y., N. H. & H. R. R., some years ago, the writer was called upon to construct a stone masonry arch at Pelhamville (now Pelham), N. Y., which would carry a four-track railroad, and yet conform to the proposed development of the property in this vicinity, which was to be that of a residential park.

The form of arch usually selected for this purpose was the segment of a circle, but in view of the artistic development proposed it seemed advisable to give the matter a little further thought and, if possible, to select a form which would be more pleasing to the eye, while at the same time maintaining the necessary strength for railroad service.

An elliptical form seemed desirable, and upon making a comparison of designs it was found that by slightly lowering the springing line to say 7 feet above the sidewalk, and placing the additional headroom necessary in the elliptical curve rather than in the straight abutment, a more pleasing effect could be produced at practically the same cost. In fact, the only additional masonry required would be that necessary to form the curve of the ellipse, in filling the sharp abutment angle at the springing of the segmental form of arch.

The elliptical form, however, did not meet with favor from those who had constructed segmental arches, and it was only after considerable persuasion that permission to construct the ellipse was granted. After a service of nearly twenty years, however, the arch still stands, without sign of a failure or blemish, doing work double that for which it was designed. It received notice of the technical press, and was selected by Messrs. French and Ives, in their work on "Stereotomy," as a type of five-center arch, but it has never received a full description until it was given as follows to the Brooklyn Engineers' Club.

The railroad embankment, at the point where it was proposed to place this arch, was so low that a plate-girder bridge had been thought the most feasible form of construction. This, however, would have been worse, from an artistic standpoint, than the segmental arch, and, because of the limited headroom, it was found necessary to make every effort in introducing the ellipse to reduce the crown of the arch to the lowest practicable height consistent with the strength necessary and the beauty desired.

The span of the arch was 40 feet, as was customary for highway under-crossings of this kind. The height of the vertical abutment, from the sidewalk to the springing line of the arch, was placed at 7 feet, as already mentioned, and from this the ellipse arose in a graceful curve, to its crown 10 feet above, and the curve from the springing gave the extra headroom clearance desired in a much more pleasing form than would have been the abrupt angle at the springing line of a segmental curve. The length of the barrel was placed at 7 feet, so as to permit an 8-foot parapet above the arch to catch the slope of the railroad embankment. The elevation of base of rail was 5 feet above the top of parapet, making a total height of 13 feet above the crown of the arch, for placing the roadbed, the earth embankment and the masonry of the arch crown.

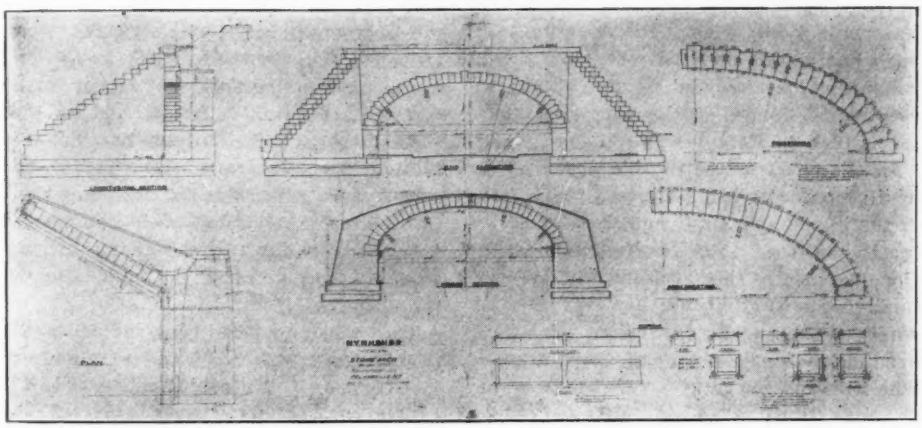
In the detailed design of the arch an ellipse was first drawn with the two axes already mentioned, and then a study was carefully made for the selection of radii of a five-center arch which would conform most closely to the lines of the ellipse. The radii of 40 feet, 20 feet, and 5 feet 7¼ inches were selected in this manner, and agree closely with the lengths which Messrs. French and Ives would select by a more exact mathematical analysis. The variation between the line of the true ellipse and that of the five-center arch drawn by these radii is only about one inch, and is not noticeable to the eye. The practical advantage of the five-center arch over that of the true ellipse is in the simplicity in laying out the curve, the facility in the stone-cutting of the arch ring and in the general practicability of the construction work.

marshy ground and necessitated excavating to a depth of 14 feet before a satisfactory bottom of compact gravel was reached.

The adoption of a five-center curve permitted of very simple stone cutting. A joint was placed at each change of curvature, this permitting joints to be radial, and each stone within the same curve was cut by the same template, requiring but three templates for the entire arch.

In the ring stones of the face the radial joints were extended to make the vertical step of the horizontal joints not less than 4 inches, and to decrease these steps in each instance from the springing to the keystone, giving an appearance pleasing to the eye and conforming to the usual rules of masonry.

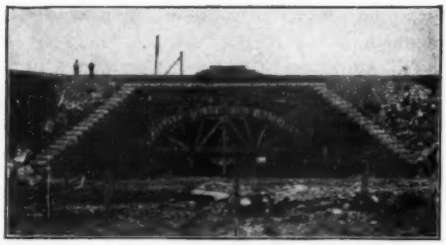
The face of the arch is square to the



Plans of Stone Arch Over Highbrook Avenue, Pelham, N. Y.

In proportioning the arch ring a full live and dead load was used for determining the thickness at the crown, and a full dead load and a partial live load to determine the variation of the line of thrust. This line of thrust was found to lie within the inner third of the arch sheeting until the shortest radius was reached, when it passed to the outer edge of the ring stones and thence down thru the abutment, remaining within the inner third of the masonry until it passed thru the foundation. The west abutment was founded on rock, but the foundation of the east abutment was on

center line of the barrel; the wing walls were spread at an angle of 45 degrees with the face and were coped with stone steps. The face stones of the arch, the parapet and the wings were of a pinkish gneiss, quarried in the vicinity of Yonkers, N. Y., and about five miles distant. The coping was of blue-stone, quarried at Palatine Bridge, N. Y., and, when fresh, was of a dark color and made a fitting trim to the masonry; but it has grown light-colored with age and exposure to the weather. Oddly enough, the photograph taken at the time of completion showed the coping lighter colored than the face



Forms for Elliptical Arch, Nelham, N. Y.

owing to the actinic effect of the bluestone as compared with that of the red tinted gneiss.

The arch sheeting and ring stones were all cut accurately in the quarry and no additional cutting was found necessary at the site. The sheeting was 2 feet 6 inches deep, and the joints cut on radial lines. The first course, at the springing, was made 3 feet deep. The intrados was bush hammered, and the rock face of the wings and parapet had no projection exceeding 1½ inches. Allowance was made for ¼-inch joints.

In the construction of this arch it was first proposed to build one-half the length of the barrel at a time, and then by shifting the railroad track to the finished portion, complete the remainder. It was finally deemed advisable, however, for the safety of the traffic, to carry the track around the work on a temporary trestle. The trestle was first constructed along the side slope of the old fill, and when the excavation for the arch encroached upon the trestle, the trestle bents were then lengthened.

The wooden erection-centering was constructed of three thicknesses of 3 x 1-inch spruce lumber. The forms were spaced three feet apart and supported at the posts and at the abutments by wedges. The strips of 3 x 8-inch lagging were laid open, and spaced under the middle of each line of stones so as to leave the joints exposed to view for accurate setting, and so that the joints might be calked before grouting. The position and direction of each radial joint was marked on the centers, which fixes a point on each radius at the bottom chord and at the arch curve on the wooden center. By these lines the stones were accurately placed in their true positions, and when all were set and grouted, the wedges were slightly drawn to bring the arch ring to solid bearing throughout. The arch was finally covered with a 2-inch coat of cement mortar, and the centers were removed seven days later. The embankment was then back-filled and the railroad track finally laid in place.

For the purpose of comparing the lines of the elliptical with the segmental arch a photograph was recently taken of an example of each. These two arches are of the same span and under the same railroad, only a mile apart. The elliptical arch stands still as perfect as when built, with such leakage as may occur trailing down the steep curve of the short end radius; while in the segmental arch a roof board has been erected over each sidewalk. One springing stone of the segmental arch was cracked soon after erection, but this crack is not due to the form of the arch, but rather to the fact that the arch is askew, and on that account the cracked stone has had excessive pressure upon it. These two arches were constructed at the same time, the segmental having been commenced first, and, owing to unavoidable circumstances, finished after the completion of the elliptical arch.

The masonry was constructed under the direction of Mr. Charles Sillery, of Mt. Vernon, N. Y., and it was due to his skill as a master mason that it was completed without fault and has continued to render such excellent service since. The following items of cost were recently furnished by him, and, even allowing for the lesser wages paid at that time, these costs indicate unusual economy in management.

The stone was delivered at the site at the following prices:

Sheathing and ring stones	$20.50 p. c. y.
Ashlar face stones	7.50 p. c. y.
Coping and steps	16.50 p. c. y.

The cost of the wooden centers in place was $1,000, distributed as follows.

Lumber for centers	$450
Bolts	100
Labor, cutting and building	90
Lumber and labor for lagging	145

Miscellaneous labor 65

Total $1,000

The cost of laying the masonry was as follows:

Laying abutments .....$0.75 p. c. y.
Laying wing walls..... 0.95 p. c. y.
Laying sheathing and rings.. 1.30 p. c. y.
Laying steps and coping..... 1.50 p. c. y.

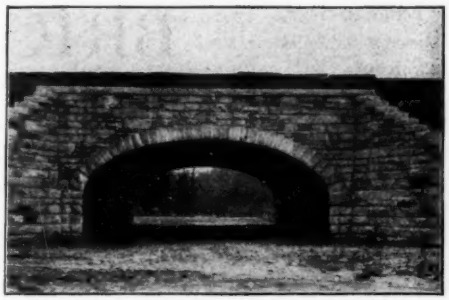
Rigging and moving four derricks, $104.00.

The foundations were of concrete, costing as follows:

Excavation .....$0.22 p. c. y.
Breaking stone ..... 0.65 p. c. y.
Mixing and placing stone.... 0.88 p. c. y.

Rigging and moving two derricks, $40.00.

The plant was hauled one mile, and removed from the work at a total cost of $50.00.



Elliptical Arch Over Highbrook Avenue, Pelham, N. Y.

The arch was completed ready for backfill within two months after the foundations were excavated.

Labor .....$1.25 to $1.50 per day
Masons ..... 2.50 to 3.00 per day
Hoister runners, $3.00.

MUNICIPAL LIGHTING PLANT COST.

East Liverpool, Ohio, a city of 21,000, is contemplating the construction of a municipal lighting plant, and has received a report from S. B. Martin, Pittsburgh, on the cost. The following estimate is furnished from figures submitted by manufacturers and contractors:

Two 625-k.v.a. steam turbines complete with 2,300 volts, 3-phase turbo alternaters, exciters, condensers and pumps	$25,000.00
Two 300-h.p. water tube boilers, erected complete with stacks, stokers and brickwork	8,500.00
Four 50-light magnetite arc lamp equipments, complete with transformers, lamps and all accessories	10,000.00
Pole line complete with arc and commercial circuits	20,000.00
One 4-panel switchboard complete	1,300.00
Two boiler feed pumps	400.00
One feed water heater	300.00
Cold water supply pumps	600.00
Transformers for consumers	4,000.00
Wattmeters for consumers	2,500.00
Wiring in power house	500.00
All piping	1,100.00
Foundation for all equipment	1,300.00
Cold storage and coal handling apparatus	2,000.00
400-lamp street tungsten equipment	2,500.00
Power house building	8,000.00
	$88,000.00

The arc-lighting system is contemplated to consist of 200 metallic frame, 4-amp. arc and 400 100-watt tungsten street lamps. The commercial lighting service is designed to serve 10,000 40-watt lights. The Council Committee on the municipal lighting plant is composed of James M. Gilgallon, Chris Norton and George Barlow.

BRICK ON COUNTRY ROADS

By Wm. C. Perkins, M. Am. Soc. C. E.,
Resident Engineer, Department of Highways, State of New York,
Niagara Falls, N. Y.

Paper presented before Section D of the American Society For The Advancement of Science, Cleveland, Ohio, January 3, 1913.

THE use of brick for surfacing country roads is rapidly gaining favor with highway engineers and the general public.

In 1909, the New York State Highway Commission decided to use a more permanent form of construction than macadam for the main highways leading into the larger cities, as many of these macadam roads were in bad condition, due to heavy traffic and lack of systematic repairs.

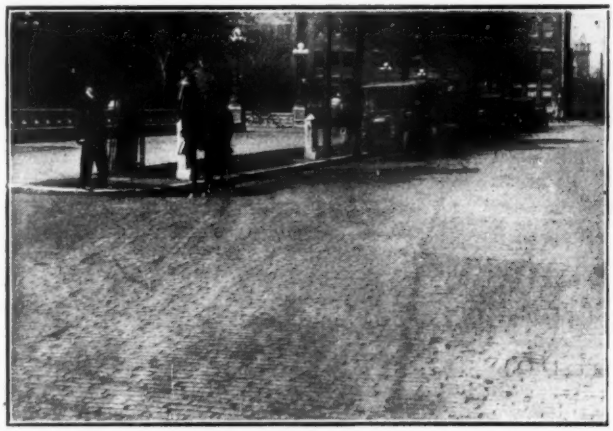
Experience has shown that a macadam roadway under heavy traffic, either wagon or automobile, is not economical, mainly on account of the high cost of maintenance.

The New York State Highway Commission, after extensive investigation, decided to use brick construction on their main highways; and, as a result, in 1910, about 20 miles of brick highways were constructed in the vicinity of the city of Buffalo. These roads proved so satisfactory to the travelling public as well as to the maintenance department (the cost of maintenance being so low), that the mileage of brick roads in the vicinity of Buffalo at the present time is about 100 miles, and this mileage will be greatly increased during the year 1913, if the present plans of the commission are carried out.

These brick highways connect the city of Buffalo and Fort Niagara (at the mouth of the Niagara River) by way of the city of Niagara Falls, and reach out, with Buffalo as a center, to all points of the compass. And I feel confident that it will not be long until every important highway leading into Buffalo will be of brick construction. This is also true of many of the larger cities of New York state, and the villages are now adopting brick construction under state aid.

The process of manufacturing brick for paving purposes has become more scientific as the demand for brick has increased and the methods of construction improved.

Streets built 20 to 25 years ago were paved with wire-cut bricks of the same size as building brick. Later, repressed brick of the small size were used. When

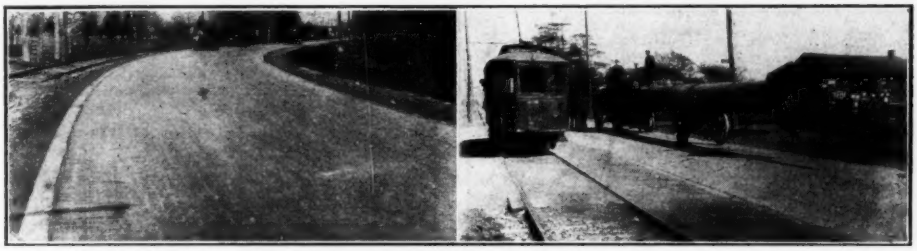


Franklin Street, Buffalo, N. Y. In Front of City Hall. Photographed May 8, 1912. Nineteen Years Old. Wire-Cut Brick Without Lugs. No Separation for Admission of Grouting Material.

the constructing engineer asked for a projection on the brick which would separate each course so as to allow the filler to enter and bind the bricks, the manufacturers placed their trade marks in the form of raised letters, on the side of the bricks. Later, more pronounced lugs were demanded; these raised letters or lugs require a reforming of the brick in stamping machines (erroneously called a repressing machine) and as a consequence the so-called repressed brick with lugs drove the old wire-cut out of the market. The size of the brick was also increased to that of the present block.

Highway engineers still demand a block with lugs, and in 1910, a wire-cut-lug block (made under the Dunn patents) was placed on the market for their consideration. During the same year, an experimental section, using these wire-cut-lug blocks, was laid on the main highway between Buffalo and Rochester, about one mile from Buffalo. This section proved so satisfactory that since that date a large percentage of the paving blocks used on the roads in western New York has been wire-cut-lug blocks.

During 1912, the records show that nearly 25,000,000 wire-cut-lug blocks were



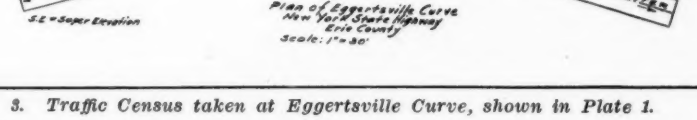
1. Buffalo-Williamsville Road, Eggertsville Curve.
2. Buffalo-Williamsville Road, showing experimental section of wire-cut-lug blocks laid in June, 1910. Photographed June, 1912.

CENSUS OF TRAFFIC
NEW YORK STATE HIGHWAY

WILLIAMSVILLE ROAD No. 69, EGGERTSVILLE CURVE ONE MILE FROM BUFFALO CITY LINE, MAIN HIGHWAY TO ROCHESTER, PAVED 1910 WIRE CUT LUG BLOCK MANUFACTURED BY THE UNITED BRICK CO. OF CONNEAUT OHIO. BUSH & PERCIVAL CONTRACTORS, M.W. WILBUR, DIV. ENGR. WM C. PERKINS RES. ENGR. STATE HIGHWAY DEPT.

	1 HORSE VEHICLE LIGHT	2 HORSE VEHICLE HEAVY	2 HORSE VEHICLE LIGHT	3 HORSE VEHICLE HEAVY	MOTORCYCLES	5 PASSENGER CAR	4 PASSENGER CAR	FREIGHT TRUCKS	TOTAL
MONDAY, JUNE 17 6AM-6PM (WEATHER FAIR)	61	25	12	42	69	101	278	17	599
TUESDAY, JUNE 18 6AM-6PM (WEATHER FAIR)	144	33	11	38	44	77	345	20	712
WEDNESDAY, JUNE 19 6AM-6PM (WEATHER FAIR)	80	28	11	46	69	103	406	13	756
THURSDAY, JUNE 20 6AM-6PM WEATHER FAIR UNTIL 6PM. RAIN FROM 6PM-8PM.	118	38	17	42	57	89	281	18	660
FRIDAY, JUNE 21 6AM-6PM (CLOUDY & SHOWERS)	92	34	16	31	38	49	244	9	575
SATURDAY, JUNE 22 6AM-6PM (WEATHER FAIR)	71	42	31	32	100	100	298	17	701
SUNDAY, JUNE 23 6AM-12M	57	16	1	2	79	81	150	2	332
12M-6PM	6	4	1	1	71	61	210	2	356
6PM-6PM.	42	2	4	0	148	102	420	4	717
TOTALS	645	262	94	234	669	713	2627	102	5346

OBSERVERS, — BLAKE WELLS & MACKLEM PERKINS.

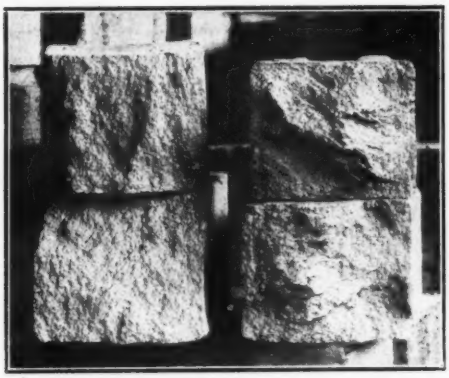


3. Traffic Census taken at Eggertsville Curve, shown in Plate 1.

used on the highways of western New York, altho the specifications of the State Highway Department do not specify any style of block, merely requiring them to have lugs.

Advantages of Wire-Cut Block to Engineer

What are the advantages of a wire-cut-lug block over a repressed block to the highway engineer?



4. Showing comparative Density of wire-cut lug block on left, repressed block on right, same manufacturer.

Density: When a brick is repressed the molecular arrangement of the material is changed under pressure, and reforming may cause laminations. The fracture of a wire-cut block is smooth and even, showing great density; the fracture of a repress block shows, very often, laminations and change of form and structure.

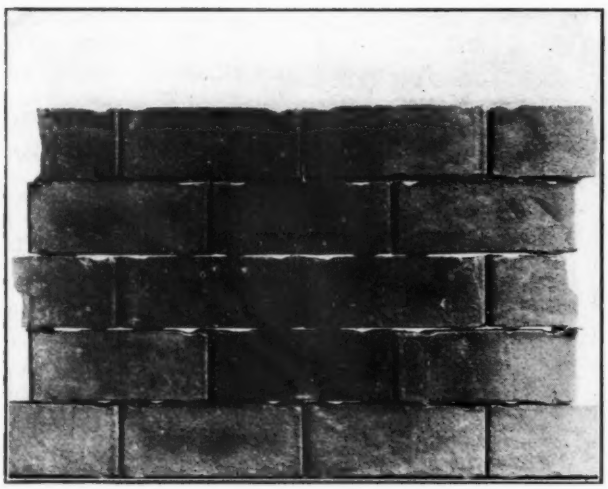
Lugs: The brick with its lugs being cut by a machine at one operation, consequently all lugs are of uniform size, while on a repressed block many of the lugs are malformed or a part remains in the mold.

Bond: The uniform lugs make a good alignment. The bricks are held an equal distance apart, allowing the free flow of filler or binding material; also, the rough, wire-cut surface, which comes in contact with the filler, gives a greater bonding strength than would the smooth surface of a repressed block.

Surface: The edges of the block being square and sharp, the filler can be brought flush with the surface and will not break away under traffic as it may from the rounded corners of repressed block. In Plates 7 and 8 notice the perfect condition of the wire-cut lug, while the filler is pounding out from the round-edged repress block.

The cement joint and blocks wear uniformly and the pavement is smooth to traffic. There are no depressions between the blocks to collect decaying matter, and the pavement is thoroly sanitary.

Abrasion: It is claimed that the rattler test shows a smaller percentage of loss from a wire-cut-lug block than from a repressed block of the same quality. If this can be proved (and I believe we can obtain authentic data from the manufacturers and testing engineers), the wire-cut-lug block must, therefore, be much stronger than its repressed brother, for the action of the rattler would be severe on the sharp corners of the wire-cut-lug block.

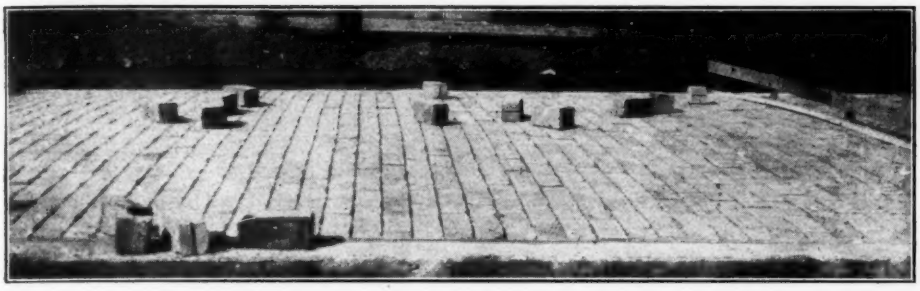


5. Showing uniformity of lugs and positive separation of blocks for admission of filler.

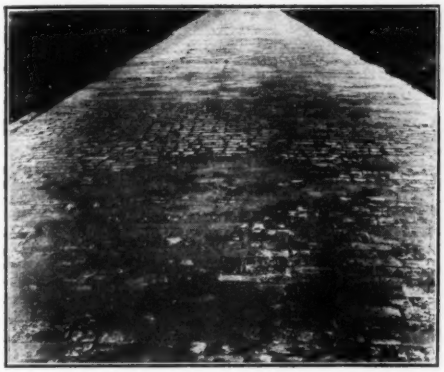
Advantages to Contractor.

What are the advantages of the wire-cut-lug block to the contractor?

Alignment: Owing to the uniformity of the lug and the uniform size of the block, a good alignment can be obtained with very little effort and it is, therefore, possible for a



6. Showing uniform alignment of courses in wire-cut-lug blocks.



1. Junction of a wire-cut-lug brick section of road and repressed brick section, on Orchard Park Road, near Buffalo. See Plate 8 in opposite direction over wire-cut-lug blocks.

8. Camera in same location as for Plate 7, but showing wire-cut-lug block pavement in opposite direction.

bricklayer to lay moresquare yards of pavement in a day.

Filler: Flush joints are more easily obtained. Two applications of cement grout are generally sufficient, thus a saving of labor.

Cost: The prices of wire-cut-lug blocks have not been increased over repressed.

Standard New York State Design

The best blocks in the world will make a bad pavement if the pavement is not properly designed and constructed. The brick highways in New York state are built according to plans and specifications of the State Highway Department, with strict inspection as to materials and workmanship.

Plate 9, Fig. 1, shows the New York state standard section for a brick country road, which calls for 16 feet of brick surfacing; 1½-inch sand bed (this will be increased to 2 inches in 1913), and a foundation of 5 inches thick of concrete, mixed 1 to 2½ to 5.

The brick surfacing is confined by a concrete edging, 6 inches wide, flush with the pavement and separated from the pavement by a well-defined expansion joint seven-eighths to 1 inch wide.

For surfacing wider than 16 feet, these longitudinal expansion joints are increased proportionally to the width of the pavement. No transverse expansion joints are used. In 1910, transverse expansion joints, placed 50 feet apart, were used with disastrous results, the blocks having become loose and crushing on each side of the joint.

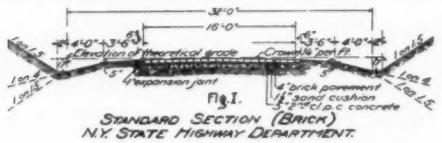
The shoulders or wings on each side of the edging are of earth, 7 feet 6 inches wide, making the width of the roadway 32 feet between ditches; normal ditches are 1 foot wide and 17 inches below the center of the road or theoretical grade; back slopes of ditches 1 on 1½; if necessary for proper drainage to deepen the ditches, or on embankment the slopes are made 1 on 4, or 1 on 1½; but if the steeper slope is used, guard rail is necessary.

The crown of the brick section is ¼ inch per foot.

Plate 9, Fig. 3, shows a special section combining a brick and earthen road used

on the highway between Niagara Falls and Buffalo.

This is very similar to the section used on the roads around Cleveland. This section has 16 feet of brick surfacing with necessary edging and wing on



9. *Fig. 1. Standard section of brick road as adopted by New York State Highway Dept.*

9. *Fig. 3. Cross-section of Buffalo-Niagara Falls Boulevard, combined brick and earthen road.*

one side of highway, and a 12 to 16-foot earthen road on the other side. This highway has just been constructed, having been opened for traffic on Christmas day, and is 17 miles in length between the city lines.

Fifteen miles of this highway is laid with wire-cut-lug blocks, the other two miles having been built in 1911 of repressed block.

The traffic, especially automobile, will be very heavy. No traffic census has been taken, but on a Sunday afternoon (two weeks before the road was opened), at a time when it was necessary to make several bad detours, 256 automobiles passed a specific point in one hour.

In the preparation of plans for a brick highway on New York state work, the designing engineer carefully examines the surveyed plan, making a new location of the center, if, in his judgment, it will improve the alignment; avoids all sharp turns, taking new right of way, if necessary. Easy grades are designed for the main highways, which often necessitates the cutting down of hills and the filling in of hollows.

The surface drainage is carefully examined, and concrete culverts used for the larger waterways and cast iron pipe for the smaller.

Construction Details

The construction of a brick highway is in charge of a constructing engineer with a force of inspectors, and he is held responsible for the proper construction of the road and for all lines and grades. The method of construction is as follows:

The road is first rough-graded, and, when sufficient material has been excavated, the sub-grade is rolled with a self-propelled road roller until it is thoroly consolidated. Any weak spots that may develop are dug out and properly taken care of by either a sub-base course or a tile drain. In some instances a combination of the two is used. The surface is then trued up by means of picks and shovels, to conform to the cross section.

The concrete used for base is made of 1 part of Portland cement, 2½ parts of clean, approved sand, and 5 parts of crushed stone or screen-washed gravel. The mixing is done by machines of the batch type. Great care is used in having the concrete base smooth and of the same cross section as the finished template, which rests on the edging forms and is drawn along as the work progresses.

Upon this concrete foundation a bed of clean, dry sand is laid, which is 1½ inches thick when pavement is complete. This sand bed is rolled with a hand roller weighing about 200 pounds, and then brought to the exact form and crown by means of a templet of the proper shape, resting on the edgings, or on scantlings embedded in the sand. The templet is drawn forward and backward immediately in front of the brick-laying,

12. *Placing concrete base for brick pavement.*

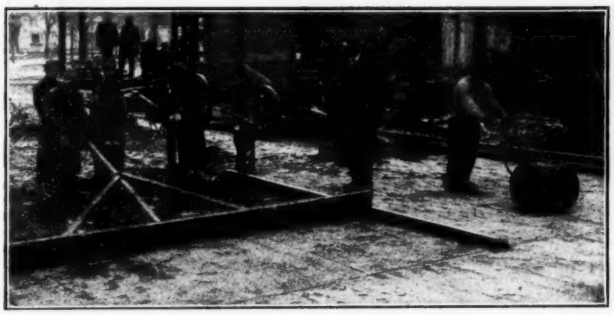
so that the sand cushion is maintained constantly at the proper cross sections.

Laying Brick

On this sand bed the bricks are laid on edge at right angles to the edging,

except at road intersections, where they are laid at such angles as directed by the engineer. All longitudinal joints are broken by a lap of one-half the length of the brick. The bricks are laid in close contact with each other by experienced bricklayers, with the lugs in the same direction.

After a stretch of pavement is laid it is inspected and all soft, broken or misshapen bricks are removed. Any brick slightly spalled or kiln marked is turned over, and if the opposite face is acceptable, it is alowed to remain in the pavement; otherwise, it is removed. Any unevenness or irregularities of the surface, after rolling, is removed by means of ramming.



13. Making sand bed for brick pavement on concrete base.

Applying Filler

The pavement is then thoroly wet by sprinkling and the filler applied. This filler and its proper application is one of the essentials of a good brick pavement. The filler used is composed of one part Portland cement and one part sharp, clean sand, mixed in small quantities and carefully applied to the brick surface by means of scoop shovels and swept at once into the joints by means of push brooms or squeegees.

14. Laying wire-cut-lug blocks on Buffalo-Williamsville Road.

Before the cement has attained its initial set the same portion of the work is gone over a second time, using the same mixture of grout, care being taken in each instance to thoroly fill all joints flush with the top of the brick. In order to secure flush joints, a third, four or fifth coat of grout is often necessary with blocks that have imperfect lugs.

When sufficient time for hardening has elapsed, a coating of sand is spread over the whole surface and kept moist during the heated period of the day, in order to obtain as uniform a temperature as possible while the grout is setting. The roadway is then allowed to remain absolutely free from disturbance or traffic of any kind for a period of ten days.

Some engineers advocate a weaker grout than a 1-to-1 mixture; others, a pitch filler; but my experience has been that better results can be obtained with a 1-to-1 cement filler properly mixed and properly applied.

Expansion Joints

The object of a filler is to make the surface waterproof, prevent undue wear of the individual block, and to join all the blocks together in a monolithic structure. The joint should become part of the pavement and, as near as possible, of equal strength with the brick. All expansion and contraction to be counteracted by the use of well-constructed longitudinal expansion joints.

15. Inspecting and rolling wire-cut-lug blocks.

16. First application of cement grout.

In constructing longitudinal expansion joints, two clapboards, or wedge-shaped boards, are used in each joint while the brick surface is being rolled and the cement filler applied. After the filler has been applied, the boards are removed, the outside board being removed first in order to avoid loosening the blocks adjacent to the joint. The joint is then thoroly cleaned to the full depth of the block and the pitch or asphaltum applied.

On all sharp curves we find it an advantage to use a wider expansion joint on the outside of the curve, as the tendency of the pavement is to move in that direction and away from the inside edging.

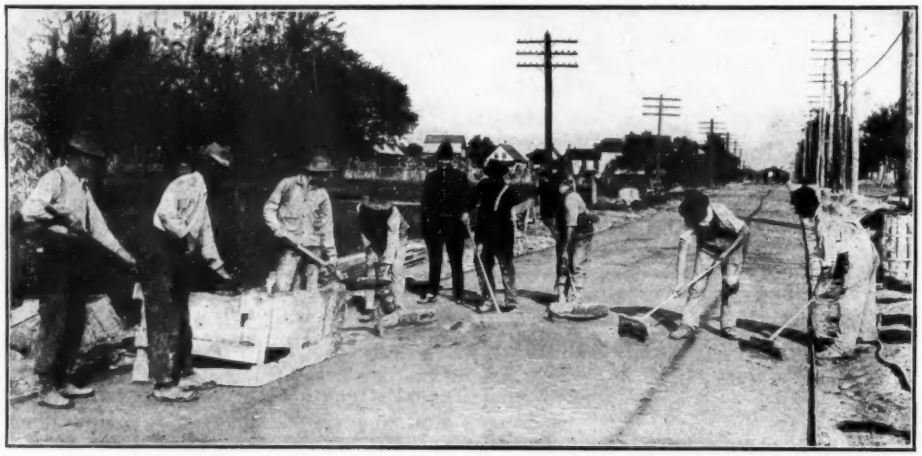
Tests of Brick

All bricks are subject to tests for abrasion and impact, according to the standard methods prescribed by the National Paving Brick Manufacturers' Association. In 1910 and 1911, when the old form of rattler was used, a block which lost over 19 per cent was rejected. In 1912 all tests were made on the new standard rattler and all blocks which lost over 24 per cent were rejected. Samples are taken at the roadside from every 200,000, or from any shipment which may be questionable.

Cost of Pavements

As to the cost of brick paving on country roads, this varies according to local conditions. Highway contractors make use of various labor-saving devices to decrease the cost of construction. All unloading of stone and sand is done by machines. Many contractors are using traction engines for the hauling of material; some use small-gage tracks with locomotives and cars.

A modern concrete mixer is very necessary.



17. Second and final application of cement grout on Buffalo-Williamsville Road.

From data obtained from various roads, a fair estimate of cost would be as follows, based on:

	Per Hour.
Labor	$0.17½
Teams	0.50
Foreman	0.35

No office or incidental charges estimated.

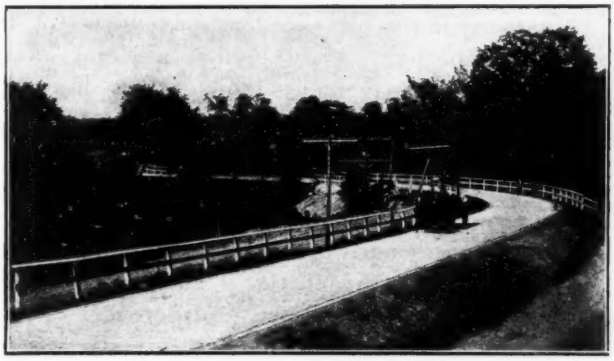
Labor per square yard, brick paving in place, exclusive of concrete base:

Unloading and piling brick	$0.035
Hauling brick 1 mile	0.040
Laying and rolling	0.070
Making sand cushion	0.020
Grouting	0.028
Expansion joints	0.007
Culling, replacing, etc	0.005
Total labor (per sq. yd.)	$0.205

The manipulation of the concrete for the base varies from 40 cents to 60 cents per cubic yard, using batch machines and depending on gravel or stone concrete.

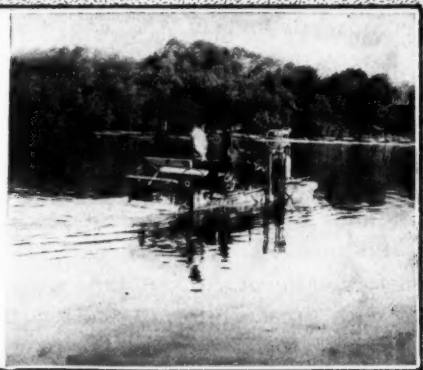
The average bid price for brick pavement in western New York, including concrete base 5 inches thick, but excluding excavation, is $2.05 per square yard.

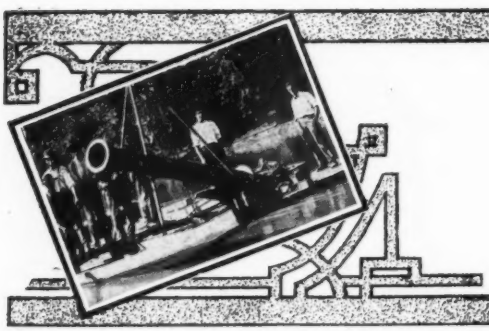
The brick highways constructed by the state of New York have given general satisfaction to the traveling public. Brick is the ideal pavement for heavy traffic; is smooth to the automobilist; originates no dust; is thoroly sanitary; and, properly constructed, will be an inheritance appreciated by our children's children.



20. Buffalo-Glenwood Road, crossing "Pipe Creek."

WEED CUTTER OWNED BY THE WEST CHICAGO PARK COMMISSION in operation in Garfield Park Lagoon, Chicago.





EDITORIAL

GOOD BRICK PAVEMENTS

We have seen recently some brick pavements which were not good, and we have seen many miles of excellent pavements of this material, some of them well nigh perfect. We therefore welcome an article on the prevention of defects in brick pavements which states the reasons for most of the defects which have been noted and lays down the principles which will produce good results.

The work of Mr. James E. Howard in measuring the changes in brick pavements with changes in temperature has put into figures the general impressions which engineers and others have developed as the result of observation. They have unearthed little, if anything, which is new, but they have made definite some things open to differences of opinion.

As in all monolithic structures, the temperature stresses in brick pavements must be taken care of by designing and constructing the pavements under such circumstances that these stresses will not be greater than the pavements can stand, both in form and material. Brick is capable of withstanding large compressive strains. Cement joints can, also, but they will show cracks under comparatively low tensile stresses. A pavement rigidly confined, if it has a plane surface so that the temperature stresses can be transmitted in straight lines, will remain in place and will keep its original condition and even be more durable on account of a certain amount of constant compressive strain. No expansion joints are necessary.

But crowning a street introduces a weakness, for compressive stress across the street tends to force the arch up in the center and sometimes explodes the pavement. Likewise, the break in straight lines lengthwise of the pavement introduced by the crowning of the cross streets introduces a weakness in that direction. Curves in the street are equally objectionable.

Methods of construction of brick streets have been developed which make the surfaces as nearly perfect as can reasonably be expected, and careful following of the standard specifications will produce these excellent results with great uniformity. It is necessary to continue the good work by improving the designs of the pavements to equal the methods of construction. This is the problem now before engineers and contractors, and Mr. Howard's work, by making the difficulties and the reasons therefor so definite, has done a great service to the brick-paving industry and the cities using the product thereof.

OPEN SPECIFICATIONS

The adoption of standard forms of specifications for the construction of public works by associations composed of experts is having quite an effect in opening specifications, particularly for paving materials, in many of the smaller cities.

The practice of requiring guaranties of pavements arose when paving materials other than stone and macadam were new and the promoters of one of the new materials, asphalt, were willing to back their judgment that they had a good and lasting material.

It was natural that the specifications should be more or less completely closed against competition, especially after a few years had demonstrated the claims of the first promoters, and still newer materials could not produce similar examples of success.

The fashion thus set has existed ever since, being succeeded by the open specification, first in the larger cities, whose work was heavy enough to warrant the expert supervision required to secure good materials and results, and later in smaller cities, as such experts offered themselves for service in any city desiring them.

Now come the A. S. M. I. and the S. P. S. with their standard specifications which provide for the use of all good materials of the respective classes and attempt to cut out the poorer kinds. With the aid of such gratuitious expert service in drawing up specifications and that of the professional experts in testing and inspecting materials and work, there is little need for a closed specification in any branch of public construction to insure good work.

But a peculiar condition frequently results after a change from closed to open specifications where the initiation of improvements depends, either by law or custom, upon the action of the taxpayers.

The average taxpayer, especially in the older cities and those which are less progressive or are laboring under temporary or permanent financial difficulties, is not petitioning voluntarily for improvements for which he must pay directly. It is necessary that someone should have enough interest to make the arguments and appeals required to secure the signatures to the petition. Contractors openly admit their interest and that they are responsible for most of the petitions for improvements which are presented.

But with specifications open to all materials and all contractors, the individual contractor may consider that his time and effort in securing petitions have too little chance of return in the shape of contracts. Therefore, petitions languish and improvements are not made.

Public spirit must then be invoked. Comparisons with other cities and with other sections of the same city must be made, and the pride of the taxpayers must be aroused. This is a job for the city's official family to undertake, but it must be done with intelligence and enthusiasm or public improvements will be slow and restricted to those which are so absolutely necessary that they cannot be put off, with an occasional petition from a street or district which has public spirit and desire for improved conditions enough to begin the proceedings.

QUESTION DEPARTMENT

Standard Specifications for Asphalt for Pavements

In connection with the letting of a contract for asphaltic concrete pavement in a neighboring city, the statement was made by parties representing the companies handling Trinidad Lake and Bermudez asphalts, that their material was far superior to that produced in this country. They succeeded in convincing, or perhaps I should say, "inducing" the council to agree with them to such a degree that their bid was accepted, although 7 cents higher than the low bid.

Will you kindly advise what is the relative values of the natural lake asphalt for this purpose as compared with the manufactured product? W., ———, Mo.

Perhaps the best reply to this question can be made by quoting the specifications for asphalt for pavements adopted by associations of experts in paving in the largest as well as in smaller cities thruout the United States.

The standard specifications of the American Society of Municipal Improvements say:

"The refined asphalts admitted under these specifications shall be prepared from a natural mineral bitumen, either solid or liquid, or from combinations thereof, by suitable and approved methods of refining."

These specifications go on to state the qualities which the refined asphalt, the fluxes, the asphaltic cement, the binder and the wearing surface shall have.

The Association for Standardizing Paving Specifications has adopted the following regarding the character of material from which the asphalts to be used in pavements shall come:

"The refined asphalt to be used for paving mixtures herein required shall be derived in the following manner:

"1. By heating, if requiring refinement, crude, natural, solid asphalt to a temperature of not over 450 degrees F. until all the water has been driven off. Crude, natural, solid asphalt shall be construed to mean any natural mineral bitumen, either pure or mixed with foreign matter, from which through natural causes in the process of time the light oils have been driven off until it has a consistency harder than 100 penetration at 77 degrees F. At least 98½ per cent of the contained bitumen in the refined asphalt, which is soluble in cold carbon disulphide, shall be soluble in cold carbon tetra chloride. In no case shall such asphalt be prepared at the refinery with any product not hereinafter provided for.

"2. By the careful distillation of asphaltic petroleum with continuous agitation until the resulting bitumen has a consistency not harder than 30 penetration at 77 degrees F.

"(a) All shipments of material shall be marked with a lot number and penetration, and ten samples taken at random from each lot shall not vary more than 15 per cent from the average penetration, providing no part of any shipment shall be below 30 penetration at 77 degrees F.

"(b) The solid bitumen so obtained shall be soluble in carbon tetra chloride to the extent of 98½ per cent.

"(c) When 20 grams of the material are heated for five hours at a temperature of 325 degrees F. in a tin box 2½ inches in diameter, after the manner officially prescribed, it shall not lose over 5 per cent by weight nor shall the penetration at 77 degrees F. after such heating be less than one-half of the original penetration.

"(d) The solid bitumen at a penetration of 50 shall have a ductility of not less than 20 centimeters nor more than 85 centimeters at 77 degrees F. If the penetration varies from 50 an increase of at least 2 centimeters will be required for each 5 points in penetration above 50, and a corresponding allowance will be made below 50 penetration. This test shall be made with a briquette of cross-section of one square centimeter, the material being elongated at the rate of 5 centimeters per minute. (Dow Moulds).

"Note: Combinations of asphaltic bitumens having the ductility and other char-

acteristics above mentioned are admitted under Section 2.

"3. Refined asphalt produced by combining crude natural asphalt with either of the following:

"(a) Residuums obtained by the distillation of petroleum oils as specified under fluxes.

"(b) Asphalts obtained by the distillation of petroleum oils as specified.

"In the use of these mixtures of refined asphalts for asphaltic cement, only asphaltic or semi-asphaltic fluxes shall be used, except in those cases where the solid natural asphalt is of such character that when mixed with paraffine flux without the addition of any other material, it will produce an asphaltic cement complying with the requirements set forth under that head. In such cases any of the fluxes elsewhere specified may be used.

"The preparation and refining of all asphalt admitted under these specifications shall be subject to such inspection at the paving plant and refineries as the proper city official may direct."

These specifications also go into detail as to the character and qualities of the asphaltic cements, etc. The theory upon which both organizations have proceeded is that a good asphalt pavement is the important thing, and that any asphalt which will produce first-class pavement uniformly may be used, whatever the source from which it has been derived.

Rates for Street Lighting

Will you please inform we where I can obtain the prices paid for electric lighting in cities ranging from eight to ten thousand population. Recpectfully,

P., City Engineer, ———, O.

In MUNICIPAL ENGINEERING, vol. xlii, pp. 254 and 387, are given rates for electricity in cities of 100,000 to 200,000. In vol. xli, pp. 52 and 300 the rates for three small cities in Massachusetts and New York are given.

The rates in quite a number of electrical plants, viz., those which are electrical departments of gas works will be found in Brown's Directory of American Gas Companies ($5).

Ohio cities of 10,000 to 20,000 population pay the following rates for street lighting:

City.	No. lamps.	Capac.	Price per yr.
Alliance	106A	450 w.	65.00
Bellaire	180A	480 w.	70.00
Bucyrus	148A	300 w.	74.50
Cambridge	185A	2000 c.p.	65.00
Chillicothe	217A	320 w.	70.00
	92I	75 w.	24.00
Defiance	100A	2000 c.p.	70.00
	1001	16 c.p.	8 c.kw.
Elyria	257A	300 w.	64.00
	2501	55 w.	3 c.kw.
Findlay	220A	6.6 a.	65.00
Ironton	157A	1200 c.p.	60.50
	140I	32 c.p.	12.00
Lakewood	306A	....	68.34
Lancaster	910A	485 w.	64.80
	8I	7.5 a.	36.00
Marietta	218A	2000 c.p.	38.00
Marion	172A	7.5 a.	82.50
Massillon	215A	450 w.	69.50
	115I	75 w.	12.00
Middletown	173A	7 a.	60.00
	25I	60 w.	25.00
Piqua	200A	4 a.	70.00
	125I	40 w.	18.00
Sandusky	225A	490 w.	66.00
Tiffin	176A	7.5 a.	75.00
	16I	32 c.p.	16.00
Urbana	106A	7.5 a.	75.00
	8001	8 c.p.	4 c.kw.

Rates for private lights are available for a few cities:

Alliance, 12.5 to 5 cents a kilowatt hour, with 5 per cent. discount for cash, and power rates 12.5 to 2.5 cents.

Bellefontaine, 8 cents gross.

Bucyrus, 10 cents.

Defiance, 10 to 8 cents.

Urbana, 15 to 8 cents, with 10 per cent. discount.

Warren's power rates are 4 to 2.75 cents, with 10 per cent. discount in 10 days.

Ordinances Governing Street Traffic

The city that I represent is contemplating drafting a traffic ordinance for the regulation of traffic upon its public streets. I am now gathering data for that purpose, and am inquiring for a copy of up-to-date ordinances on that subject. If you have any such ordinance in your files I should be glad for a copy thereof. J. E. C., City Attorney, ——, Cal.

Copies of ordinances governing automobiles will be found in MUNICIPAL ENGINEERING, vol. xliii, pp. 38 and 388, taken mainly from those in force in Indianapolis. Cincinnati recently adopted some additions to and changes in its vehicle ordinance which now make it one of the most complete in force. Cleveland and Atlanta also have quite comprehensive ordinances, covering the operation of all classes of vehicles, which are too long to reproduce in this department.

Bacteria in Sewer Air

I would be much obliged for the reference necessary to look up the reports on the investigation in Gibraltar by a British engineer and that carried on in America for the Master Plumbers' Association re the question of the presence of pathogenic bacteria in sewer gases.

W. MUIR EDWARDS,
Strathcona, Can.

The investigation into the subject of bacteria in sewer air, made at Gibraltar, was made by Major W. H. Horrocks of the Royal Army Medical Corps of Great Britain, and was published in the proceedings of the Royal Society, Series B, vol. xxix, No. B 531, p. 255, in 1907.

There is a report by F. W. Andrews on the micro-organisms present in sewer air, and in the air of drains printed in supplements to the 36th and 37th annual reports of the local governing board of Great Britain containing the reports of the medical officer for 1906-7-8.

The investigation made for the Master Plumbers' Association was made by C. E. A. Winslow of the Massachusetts Institute of Technology, Boston. It appeared in a report of the sanitary committee of the association for 1907-8-9.

Must Bids for Extras Be Advertised For?

We are now engaged in a suit with this county which involves the question as to whether or not the county commissioners had the legal right after awarding us the contract, to award us in addition to the original contract, contracts for extra work that was to be done on the building without advertising for each separate extra.

If your department is so arranged that we could obtain from you a list of referencess referring to the decisions by the different courts on this subject, we greatly desire to do so. B., ———, Fla.

If constitutional or statutory provisions prohibit changes in amount to be paid on contract such changes cannot be made. Shelby Co. v. Gibson, 18 Tex. Civ. App. 121. 44 S. W. 302; King v. Mahasla Co., 75 Iowa 329, 39 N. W. 636; Burlington etc. R. Co v. Benton Co., 56 Iowa 89, 8 N. W. 797; Reichard v. Warren Co., 31 Iowa 381; Keith v. Ozallas Power etc. Co. (Nebr. 1902), 89 N. W. 375.

But in the absence of such constitutional or statutory prohibition the county board may make the necessary changes in matters of details, and increase or decrease the price accordingly, but cannot make important general changes in the plan of the building, or insert in the formal contract, after advertisement and award, stipulations not in the specifications, advertisement, etc. Gibson Co. v. Cincinnati Steam Heating Co., 128 Ind. 240, 27 N. E. 612, 12 L. R. A. 502; Kitchel v. Union Co., 123 Ind. 540, Ex. N. E. 366; Benton Co. v. Patrick, 54 Miss., 240; Highland Co. Comrs. v. Rhoades, 26 Ohio St. 411.

Have our readers knowledge of other decisions on either side of the case?

Consumption of Water in Cities.

What tabulated information have you which will give the approximate consumption of water per capita by the cities and towns of the United States?

B. ———, Ogden, Utah.

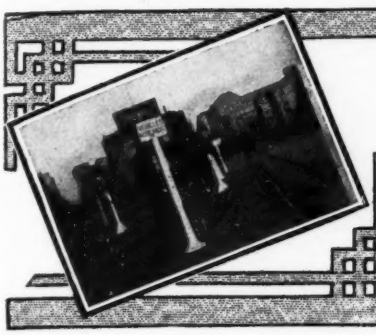
The volume of statistics of cities, for 1907, issued by the United States Bureau of Statistics, Department of Commerce and Labor, Washington, D. C., gives the consumption of water in cities of over 30,000 population, and is the most recent and reliable report on this subject.

Turneaure & Russell's "Public Water Supplies" gives the consumption per capita in a number of cities.

In MUNICIPAL ENGINEERING, vol. xxx, p. 18, is a list of cities and towns of 2,000 to 5,000 population, giving the consumption of water, and in vol. xxxvii, pp. 258 and 330, are a number of brief descriptions of water works in cities of 25,000 to 30,000 population, with a statement of the consumption of water.

Reports of the American Water Works Association contain tabulations of water consumption, particularly in articles concerning metering of water systems. John M. Diven, Troy, N. Y., is secretary of the association and can supply the volumes of proceedings.

GARFIELD PARK CONCRETE MANURE PIT AND CREMATORY of West Chicago Park Commission, Chicago.



WORKERS IN THE FIELD

Automobile Truck for Refuse and Street Sweepings

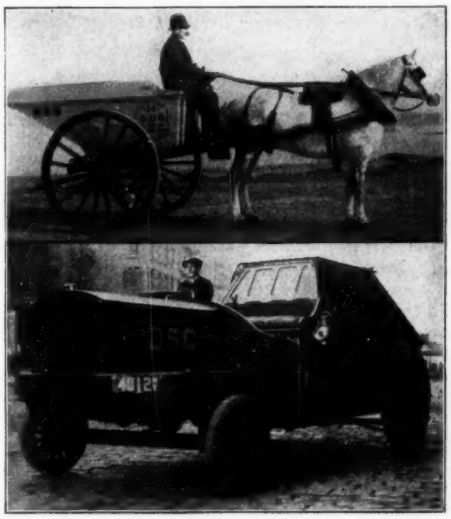
The Editor of MUNICIPAL ENGINEERING:

Sir—Some two years ago Commissioner Edwards took up the discussion of the motor truck with the superintendent of industries of the state prison at Sing Sing, where the carts are now being built, and found that bureau anxious to co-operate in the solution of this problem for the benefit of all the municipalities in the state with whom this industrial department is constantly doing business, and the prisoners engaged in the construction of carts and wagons under the direction of Mr. Butler, the foreman and constructor of the shop, commenced work upon a truck for this purpose. The result is that a practical machine has been built.

This auto dump cart is something unique, not alone in its construction and because of what it will do, but also on account of the conditions under which it is built. It is a remarkable fact that not one of the men who worked on the auto is a machinist. They had been bakers, bar tenders, 'longshoremen, sailors and laborers of similar capacity, and not one of the eighteen or twenty men had ever worked on an automobile or knew anything about machinery other than that they had learned in the course of their labors in prison. They were further handicapped by the fact that the cart and wagon shop is not equipped for automobile building, but had been confined solely to the construction of horse-drawn steel dump carts, such as are now used in this city by the street cleaning department and others.

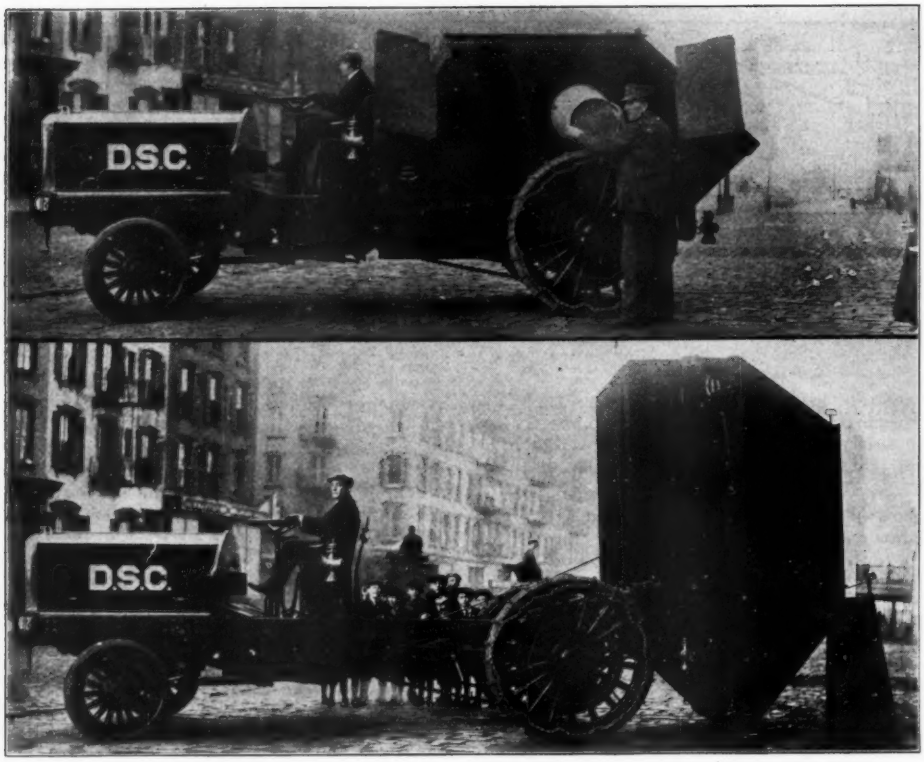
The men overcame these difficulties, however, and entered into the work with interest and enthusiasm. They had books on the automobile and studied them, together with descriptive catalogues on which they spent most of their leisure hours, and they drew plans of parts and improvements, brought them to the shop, submitted them to the judgment of their co-workers and instructors, and worked in their cells during the evening hours and on Sundays trying to devise improvements or solve the difficulties met in the work. One man who became ill sent suggestions from his bed in the hospital, and when dying said that he would be satisfied if he could live to see the auto completed and ride in it once around the yard.

When in July of 1911 the prison authorities changed it was found that tho much work had been done and good results accomplished, the auto was not yet a practical machine; but the superintendent of state prisons, Col. Joseph F. Scott; the



Old and New Methods of Carrying Away Street Sweepings and Refuse in New York City.

warden, Mr. John S. Kennedy, and the superintendent of industries, Mr. Patrick J. Tracy, at once took up the matter of remedying the defects in the auto, and the men who were found to be most interested in their work were encouraged to



Automobile Car for Carrying Street Sweepings and Refuse, Made in Sing Sing State Prison for New York City. Loading and unloading.

renewed effort, and with renewed interest and enthusiasm worked, with the result that a machine was perfected and completed to the satisfaction of all concerned.

The truck is constructed of steel, has a body with a capacity of five cubic yards water measure, but when fully loaded carries eight cubic yards, and is so constructed that the top of the sides is of a reasonable height, permitting easy loading. It has a cover of a new design, which is dust proof and which will confine odors during transportation. This cover is easy to operate, is in sections having a number of doors, only one of which can be opened at one time, and which will not interefere with the loading, and are easy to operate. This cover does prevent the dust being blown about in the loading operation, which is the great nuisance attending the use of open or partly open carts. The body of the truck is dumped by a peculiar mechanism which permits it to be completely and speedily emptied, because it raises the body to a perpendicular position. This raising mechanism is composed of a worm and sector gear, here used for the first time in connection with a dump cart. This device is not only effective, but it is the safest possible, because it has a safety device which locks the body while it is being raised, so that there can be no injury by the fall of the body, and is so arranged as to stop when in exactly the right position for dumping, be held perpendicular for the dumping, and then lowered. This makes the operation of dumping completely automatic and independent of the driver, which meets the requirements usually made for such a device of its being "fool-proof." It is a stanch machine, simple in construction, and with little danger of getting out of order, even in inexpert hands. The parts can be easily and cheaply repaired.

On November 19 Commissioner Edwards visited Sing Sing Prison and witnessed the operation of this truck, and was satisfied that it thoroughly met the requirements of the department. It was given a severe test, loaded with six tons of steam ashes, and dumped as the carts are in actual work at the dumps of the department of street cleaning. The commissioner was then taken in the truck for a ride of four miles up the steep hills, which are so numerous in the vicinity of Ossining, and, though the chauffeur chose the hardest of them, the truck maintained

a uniform speed of twelve miles per hour. The commissioner was well pleased with the test, and the warden and superintendent of industries believe that they have introduced a profitable and successful industry in the prison, which, besides being profitable, is one which the men will take an interest in and in which they will gain a knowledge which will help them to become useful members of society.

DEPARTMENT OF STREET CLEANING,
City of New York.

Cleaning of Sewers

The Editor of MUNICIPAL ENGINEERING:

Sir—Sewers should be thoroly cleaned and kept in a cleanly condition at all times.

Our first experience in sewer cleaning by means of modern machinery was a success. During our test, it is but far to state, that the work was done under conditions which should not exist owing to construction and lack of manholes. The two blocks of 24-inch sewer contained 21 inches of accumulations of sand and slag, decomposed organic and vegetable matter, and it was almost impossible to get the sewer rods thru in order to attach the front end of the turbine machine. This sewer emptied into a 36-inch sewer, which had a mile and a quarter to run to the Ohio River and was partly filled up, which you naturally would think would form an obstruction for the proper cleaning of the two blocks of 24-inch sewer. But after pulling the machine thru the two blocks, we found no perceptible difference in the 36-inch line, and the test was a success.

Clean sewers mean less gas and we all know that gas exists in sewers. Whether it be from gas mains or decomposing animal and vegetable wastes, matters not. It exists, and we know by experience that the breathing of sewer air from an open manhole or soil pipe or waste will soon cause headaches, nausea, etc.

JOHN P. PASTRE,
Sec. McKees Rocks Borough, Pa.

How to Handle Quicksand in Sewer Trench

The Editor of MUNICIPAL ENGINEERING:

Sir—In regard to quicksand encountered in our sewer work. John Brogan, Green Bay, Wis., had a contract for $26,000 worth of sewer work, a great deal of this was thru quicksand and earth which would not stand up. The quicksand and water was usually encountered in pockets, so that it was not deemed advisable to use well points. The foreman used double sheeting and stopped running water by using sod and hay. Cinders were used as a bed to lay the pipe on, and occasionally it was necessary to have the men stand on the pipe which had already been laid in order to keep it in place. I think if well points had been used it would have been a little more economical.

M. J. DOUTHITT,
City Engineer, Waukegan, Ill.

Fargo Declares a Municipal Dividend

The Editor of MUNICIPAL ENGINEERING:

Sir—I have your esteemed inquiry of recent date, regarding refund or dividend, payable to the taxpayers of Fargo. In explanation, I would say that when we made our annual budget for the fiscal year, on September 1st last, we found the same amounted to $146,561.00, which was to be obtained from a direct levy. This sum covered the estimated expenses for all the departments of the city for the ensuing year, and in our endeavor to reduce the amount we resorted to the following proposition:

There will be paid into the city treasury for the ensuing year, $12,000, from the following sources:

Utility companies' gross earnings taxes	$6,000
General license to circuses, employment agents, etc.	3,700
Dog taxes	500
Police court fines	1,800

Our charter prohibits the expenditure of money unless an appropriation has first been made and the purpose of the appropriation stated; the charter also provides that no appropriation can be made except on September 1st.

Our appropriation is made on September 1st, but the taxes are paid on March 1st, six months later. We would, therefore, have normally accumulated in the treasury $6,000, from the above miscellaneous sources. But as only one-half of the annual appropriation would have been expended, we would still be a long way from the end of our annual resources and it would, therefore, be perfectly safe not only to use the $6,000 accumulated on March 1st, but also the anticipated remaining $6,000 from miscellaneous sources. We, therefore, reduced our annual tax levy $10,000 and made an appropriation of $10,000 from the above anticipated sources to the annual budget, thus making good the deficit and at the same time reducing the amount that the taxpayers would have to pay on March 1st between 6 and 7 per cent.

The purpose of this operation was to avail ourselves of the use of $10,000 for the benefit of the taxpayers which would otherwise lie idle in the city treasury at a loss of interest until September 1st

of the following year, at which time, under the old order of things, it would have gone into our contingent fund, where it would constitute a continual temptation to extravagant expenditures, as we have found in our past experiences.

The term dividend was applied because this $10,000 was the income or profits of business operations on the part of the city with private individuals and corporations, and not derived from the taxpayers, and could be deemed a dividend to be distributed among the taxpayers, or in reality, the stockholders of the corporation.

WM. D. SWEET,
Mayor, Fargo, N. D.

Rolling Mill Cinder for Sewage Filters

The Editor of MUNICIPAL ENGINEERING:

Sir—Trouble is frequently experienced by civic engineers who endeavor to give a secondary purification to the sewage of their cities by passing it thru slag beds after it has gone thru the settling or septic tanks. For over ten years the city of Hamilton, Canada, with a population of a hundred thousand, and other adjacent cities, has had the continuous problem of securing a stone or slag, which would not only give the sewage a satisfactory secondary purifying treatment, but would not clog the filters or disintegrate. After many years of costly experimenting, during which the civic administration was harshly criticised, the engineer of that city, Andrew F. Macallum, has found a satisfactory material, which costs little more than ordinary slag or stone, and which is being investigated by engineers from various parts of the Dominion.

Experience has shown that slag with a great percentage of lime, such as that from the ordinary blast furnace or open hearth, will ultimately be affected by the sewage flowing over it, in fact, it will be seriously impaired by the constant flow of even pure water, disintegrating, reducing the open spaces between the particles of slag and, consequently clogging the filters.

The composition of the average blast-furnace slag, that used by nearly every city with filtering plants for sewage disposal, is as follows:

Silica, 34.36 per cent; alumina, 14.48 per cent; lime, 37.79 per cent; magnesia, 11.41 per cent; sulphur, 2.17 per cent; manganese, 0.34 per cent.

The open-hearth slag has even a greater percentage of lime, and hence is less desirable. Its composition is:

Ferrous oxide, 11.35 per cent; silica, 17.75 per cent; alumina, 1.72 per cent; lime, 48.90 per cent; magnesia, 5.76 per cent; sulphur, 0.311 per cent; phosphorous, 0.504 per cent; manganese, 3.45 per cent.

The new material, which Hamilton's city engineer has discovered after much investigation and experiment, is called mill cinder, is taken from a blast furnace, and is composed of the following:

Ferrous oxide, 61.92 per cent; silica, 27.92 per cent; alumina, 3.64 per cent; lime, 1.84 per cent; magnesia, 1.18 per cent; sulphur, 1.18 per cent; phosphorus, 0.066 per cent; manganese, 0.26 per cent.

This mill cinder, which has a large proportion of iron, has not so far been tried to any great extent in connection with sewage disposal plants. It is extremely valuable for that purpose, however, for the reason that it will not break down and clog the filters, and, aside from this feature, it has many good qualities. Wherever it has been tried there has been good success, and as soon as Hamilton establishes several more sewage disposal plants, two of which are at present under way, the new mill cinder will be used exclusively and given an exacting test.

The relative values at the plant of the mill cinder and the slag given in the above formulae are 80 cents for the former and 35 cents for the latter, per ton. Those who have had any great experience in sewage disposal would prefer to pay even the additional cost and secure a material that would not disintegrate and cause clogging, the bane of the existence

Fishing in Los Angeles Parks

The Los Angeles Park Commission provided a treat for the children last spring, when they issued an order that fishing would be allowed in the park lakes, which had become overstocked with carp. This invitation to angle was extended to children only, persons over sixteen being barred. The banks were thickly lined with small boys and girls.

of sewage plant supervisors, which comes sooner or later where the ordinary blast-furnace slag is used.

Other materials that have been tried out in sewage disposal plants are old crockery, slate and vitrified brick. They are quite suitable, but on account of scarcity or cost it is hard to secure sufficient quantity of these for any but small plants. Coke also has been used, but it was found that it would break down shortly and cause clogging. Broken stone seems to be used in many districts, and as far as can be ascertained, it is giving satisfaction. If soft limestone is used, however, the effects are about the same as from the use of slag.

Taken all around, the experience in Hamilton so far has been that the mill cinder will fill the need of sewage disposal plants all over America.

The relative costs of the various materials placed in the filter were:

Broken stone, $1.60 per ton; slag, $1.00 per ton; mill cinder, $1.60 per ton.

HUGH L. HUMPHREY,
Hamilton, Ont.

Regulating Standing of Vehicles on the Street

As a result of a thoro discussion of the relative rights of foot and vehicle traffic and the consequent relative widths of carriage way and sidewalks, the city of Birmingham, Ala., passed an ordinance, in December, 1912, regulating the standing of vehicles on the street, which reads as follows:

Be it ordained by the board of commissioners of the city of Birmingham, as follows:

Section 1. That it shall be unlawful to cause or permit vehicles of any kind to be placed or stationed within twenty-five (25) feet of the intersection of any two streets, or within ten (10) feet of the intersection of any alley with a street within the following described area, namely:

All that part of the city of Birmingham lying north of the center of Morris avenue, from Seventeenth street to Twenty-second street, and south of the north side of Fifth avenue, from Seventeenth street to Twenty-second street; west of the east side of Twenty-second street, from Morris avenue to Fifth avenue, and east of the west side of Seventeenth street, from Fifth avenue to Morris avenue.

Section 2. That it shall be unlawful to cause or permit vehicles of any kind, within the above described area, to be placed or stationed in that part of the street which lies opposite any main entrance or entrances of any office building, public building, hotel, theater, church or bank, and between the curb nearest the main entrance or entrances of said building or buildings and the center of the street; or to cause or permit vehicles of any kind to be placed or stationed in that part of the street lying within twenty-two and a half (22½) feet from the intersection of the curb and a line drawn perpendicularly to it from the center of any main entrance of any office building, public building, hotel, theater, church or bank; provided that nothing in this section shall be so construed as to prevent the temporary stopping necessary in getting out of or into a vehicle or in loading or unloading it.

Section 3. That any person, firm or corporation violating any provision of this ordinance shall, upon conviction, be punished as provided in Section 1,261 of the Code of Alabama.

Commissions on Patents from an Attorney

Dear Sir—I presume that you are frequently requested by your clients to refer them to a reliable and competent patent attorney, and I am pleased to offer my services and wish to make it to your interest and advantage to refer such inquires to me, believing that an experience of more than 25 years in the conduct of mechanical, chemical and electrical cases enables me to guarantee entire satisfaction in any class of work you entrust to me.

In order that you may find it mutually satisfactory and profitable to co-operate with me, I agree to attend to all matters of a patent nature you submit to me upon a basis of an equal division of my fee, and to enable you to solicit cases, I present the following information.

The total cost of a United States patent is $70, which covers the search fee of $5, the government application fee of $15, the final government fee of $20, the cost of one sheet of official drawings of $5 and my fee of $25, of which you receive one-half or $2.50 of the search fee and one-half of my fee or $12.50, making a total of $15 as your commission on each case.

The total cost of a design patent is $40 for a three and one-half-year patent, $45 for a seven-year patent and $60 for a fourteen-year patent, the government fee being $10, $15 and $30 and your commission will be $10.

The cost of a copyright, which protects books, maps, charts, pictures and other publications or printed matter is $5, and you will receive $2 as your division of the fee on each copyright sent.

The total cost of a trade mark is $30, covering search fee of $5, cost of drawings of $5, my fee of $10 and government fee of $10, of which you receive $7.50.

I will also be willing to attend to your personal cases upon the same basis and your profession brings you in contact with the class of people who are constantly inventing and you can with perfect propriety solicit cases, and you surely will meet with success.

I am pleased to refer you to—(several names).

I hope to hear favorably and should you desire any further information, I will be glad to furnish it to you.

————, Washington, D. C.

The above letter was received by a civil engineer who transmitted it to the editorial department. It is from a patent attorney whose name is omitted because the letter is not to the editor, and because it is best not to advertise him, though his name will be given to any one who wishes to protect himself against the possibility of doing business with such a man. His offer is on a par with any other offer of commission on materials furnished or return for favors done, so far as the recipient of the offer is concerned, and is on a lower plane so far as the proposer is concerned, because he is a professional man and may be presumed to have higher ideals of professional courtesy and honor than some of those who are engaged in business without professional characteristics. If the letter contains basis for disbarment proceedings the original will be supplied if required.

Heavy Motor Traffic on Sheridan Road, Chicago

The Editor of MUNICIPAL ENGINEERING:

Sir—We believe that the following statement of traffic record taken from 7 a. m. to 9 p. m., September 1, 1912, on the bitulithic pavement laid in the year 1905 on Sheridan Road boulevard, Chicago, from Huron street to Evanston avenue, a length of approximately 3,000 feet, will be of interest to your readers:

Character of Vehicle.	No. of Vehicles.	Estimate of Tons.
Horse-drawn pleasure vehicles, estimated ½ ton each.....	87	43
Bicycles, estimated at 150 lbs.	187	14
Motorcycles, estimated at 300 lbs.....	550	82
Automobiles, estimated at 1¾ tons.....	6,765	11,838
Total	7,589	11,977

Width between curbs, 40 feet.

Number of tons per foot of width, 299 tons.

The bitulithic pavement at the date of taking this traffic record had just completed its seventh year of use and had received no repairs since being laid, and has received universal commendation of taxpayers and officials.

WARREN BROTHERS COMPANY,
Boston, Mass.

Reduction of Fire Loss in Grand Rapids

Introduction of motor apparatus is credited with being the most potent force in reducing the fire hazard in Grand Rapids. In 80 per cent of the fires in the past two years the reports show damage ranging from $5 to $200 and that the fires had but a short start when checked by the fire department.

The fire loss for 1912 was approximately $150,000, which was considerably less than in either 1910 or 1911.

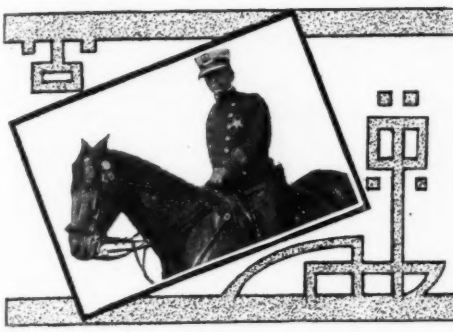
Whistles Move Pedestrians Also

Chicago is trying the experiment of moving the crowds of pedestrians across the corners of State and Madison streets with the vehicle traffic. Heretofore the whistles, one to go north and south, and two to go east and west, have governed vehicle traffic only, and pedestrians have crossed as they pleased. The crowds have become so great and the danger of accidents to pedestrians crossing thru a stream of vehicles is so great that the council has passed an ordinance requiring foot passengers to obey the crossing whistles at the most congested crossing in the city. Pedestrians cannot pass diagonally across, but must follow the sidewalk crossings. Several policemen were necessary to keep the crowds in check on the first day of the application of the ordinance, and instruct them in the signals.

The experiment promises to be a success, and if it is the ordinance will be extended to cover all the street crossings within the loop district.

Competition in Plans for Residence District

At its housing exhibition, which will open March 7, the City club of Chicago offers prizes for the development of 160 acres, a quarter section, as a residence district about 8 miles from the business district of the city, with the usual gridiron plats on all the surrounding quarter sections. Prizes of $300, $200 and $100 and honorable mentions are offered. Plans must be filed at the office of the City club, 315 Plymouth Court, Chicago, by March 3, and the award will be announced by March 10. Full information and specifications concerning drawings to be submitted can be obtained of George L. Hooker, civic secretary of the club.



LEGAL DECISIONS

Substitution of Reinforced Sewer Pipe for Reinforced Monolithic Sewer

In the case of Brobst v. the City of Reading, Pa., reported in 85 Atlantic Reports, P. 31, the contractor agreed to complete the work in "strict and exact accordance with the terms, conditions and specifications attached to it."

The specifications called for a reinforced concrete pipe, built monolithic, and the express stipulation was that, at the end of each day's work of construction, the concrete should be finished to a vertical joint, against which the next day's work should butt, the joint to be covered with a concrete ring or collar of designated width and thickness. The contractor entered into the contract with the deliberate intention of substituting a pipe known as the Leet pipe, made up of short sections manufactured outside of the trench. This pipe differed materially in the mode of reinforcement from that required by the specifications, and was two-fifths thinner. The pipe was laid by the appellant in palpable disregard of the specifications.

The pipe leaked at most of its joints, and, when he stopped the leaks by widening the trench and building concrete rings around the joints, he did only what he ought originally to have done. In no sense can this last work be regarded as extra work, for which compensation ought to be allowed; for if the appellant had laid a pipe in accordance with the specifications, and there had been leaks, he was bound, by the seventy-eighth clause of the specifications, to stop them by tearing up, if necessary, the entire pipe line and relaying it at his own expense. The answer made to this is that the city's board of public works had assented to the use of the Leet pipe. Suppose it had. Leaks in the pipe to be laid were to be stopped "at the expense of the contractor." But even if this were not so, the plea of the contractor to be paid is unavailing for another reason. His contract was with the city of Reading, and not with its engineers or board of public works. They were but its agents to act for it in the preliminaries leading up to the contract, to formulate the terms of the same and to see that they were performed; and the contractor was bound to take notice of the extent and limits of the powers of these agents. What the city engineer and the board of public works permitted the contractor to do was not the city's permission. The powers of the engineer were to interpret the contract, not to change it; and yet this is what he undertook to do. No deviations from the approved plans and specifications were to be allowed, unless by the written consent of the city engineer, approved by the board of public works. For, what was more than a mere deviation by the contractor from his contract with the city, he did not even have the written consent of the engineer.

Decisions of the Higher Courts of Interest to Municipalities

Extras in Sewer Contract—Relaying for Defective Alignment—Change of Grade— Where the relaying of a sewer pipe by a contractor was occasioned from its having been improperly laid out of alignment in the first instance, the city was not liable for such relaying of pipe, though it had made a slight change in the grade, which was in no wise responsible for the additional work. Where a sewer construction contract provided that claims for extras must be presented before final acceptance of the work, and no claim was presented for relaying pipe, the fact that the city allowed as an extra for the relaying of part of the pipe did not entitle the contractor to recover as an extra for the relaying of the remainder of that relaid.

City Can Pay Claims Against Contractor From Money Due Him—Under a sewer construction contract providing that the contractor should pay for all labor and assistance upon the work, and that any and all payments under the contract could be withheld until such wages or assistance were fully paid, and that 70 per cent. of the amount earned should be paid the contractor as the work progressed, and the remaining 30 per cent. be retained to secure the payment of laborers and materialmen, the city was entitled, after having exhausted the 30 per cent. in payments to lien claimants, to apply the balance on hand of the 70 per cent. to the

payment of labor and material in preference to the rights of the contractor's assignee, especially where the assignment stipulated that it was not valid as against any claim for labor and material furnished in the prosecution of the contract.—1st Natl. Bank v. Seattle (Wash.), 127 Pac. 837.

Damages for Insufficient Sewer and Inlets Thereto—Though at the time a sewer was built it was adequate to carry off accumulated water, where it was rendered insufficient by reason of a construction of a feeder sewer and of new streets and their consequent drainage into the latter sewer, a right of action accrued upon the causing of damage from the overburdened sewer, and the failure to construct sufficient catch-basins to carry off the surface water.

Water Company Not Responsible for Damage by Fire—An action *ex delicto* cannot be maintained against a water company by a taxpayer whose property has been destroyed by fire in consequence of the company's failure to comply with its contract with the municipality to furnish water for fire protection.—German Alliance Ins. Co. v. Home Water Supply Co. (Spartanburg, S. C.) 33 Sup. Ct. R. 32.

Indiana Cities Can Lease Sewer from Contractor—Acts 1907, p. 499, which provides that in case cities of a certain number of inhabitants are unable to pay for sewers constructed therein, the title shall remain in the contractor who constructs it, and that the city shall have power to grant a franchise to such contractor to operate such sewer and to lease the sewer for the drainage of the city streets, alleys, etc., is constitutional.—Jordan v. Logansport (Ind.) 99 N. E. 1061.

Engineer is Arbiter of Terms of Contract—Where the contract for a public improvement provided that an engineer should be final arbiter as to the meaning of any clauses therein, a construction by him is, in the absence of fraud or collusion, conclusive. Where the contract between a construction company and a municipality, providing that its engineer should be the final judge as to the meaning of its terms, had already been interpreted by him, a subcontractor, whose contract with the construction company incorporated the principal contract by reference, is bound by such interpretation.—Wilson & Adams Co. v. Mack Paving & Const. Co. (N. Y.) 138 N. Y. Supp. 407.

City Liable for Damage from Overflow of Sewer Negligently Constructed or Maintained—It is an actionable wrong for a municipal corporation to negligently construct or maintain a sewer, whereby surface waters are diverted, and by artificial means collected in a body and discharged upon growing crops of a private individual, to his detriment—Chickasha (Okla.) v. Looney, 128 Pac. 136.

Water Company Must Supply Water for Public Fountain—The establishment and maintenance of a fountain, at the intersection of two principal and much traveled streets, for quenching the thirst of animals using the streets, is a "city purpose," and a water company, under a contract with the city which requires it to furnish water to the extent of 12,000,000 gallons every six months free of charge for city purposes, cannot collect from said city for water supplied to such fountain.—Water Supply Co. of Albuquerque v. City of Albuquerque (N. M. 128 Pac. 77.

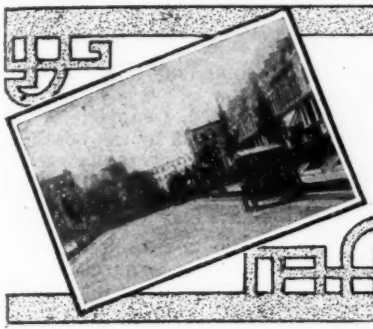
City Liable for Damage from Obstructed Drain and Method of Relieving Flood—Where a city grades a street across a natural water course, it, though not required to provide against unprecedented floods, must provide and maintain sufficient means for passage of the water, not only when it is at its lowest, or even at its ordinary, stage, but in time of ordinary freshets. Though a city, in grading a street across a gulch, be not required to furnish drainage for surface water, yet it, having exercised its discretionary power to do so, and constructed an adequate drain, is under a positive duty of exercising reasonable care to maintain its original efficiency, making it liable for its negligent failure in such duty. Where a city graded a street across a stream, and allowed a culvert constructed under it to get clogged, thereby causing a pond, which floated a house, and then, to drain the pond, cut the cribbing at the lower side of the fill, causing it to give way and the water to go out with a rush, wrecking the house, the city, if not liable for such wrecking as a consequence of its primary negligence in allowing the clogging, is liable if negligent in the cutting of the cribbing.—Ronkosky v. City of Tacoma (Wash.) 128 Pac. 2.

Water Company Must Repair Service Pipes in Street—In the absence of an ordinance requiring or permitting householders to repair service water pipes located in the streets, such householder has neither right nor authority, nor is it his duty, to repair the service pipe connecting his premises with the city water main, where it is located in the street, but such duty devolves on the waterworks company or the city furnishing the water.—Van Noman v. Meridian (Miss.) Water Works Co., 59 So. R. 883.

Liability for Change of Grade of Street—A city has the right to change its street grade, and to alter original plans and specifications for that purpose, and in so doing there is no negligence per se; and hence a city is not liable for interference with drainage of surface waters thereby, unless negligence in fact is shown.—Chidsey v. Pascagoula (Miss.) 59 So. R. 879.

Council Not Court Must Fix Water Rates—Hurd's Rev. St. Ill. 1909, c. 24, sec. 267f, after authorizing city councils, by ordinance, to fix maximum water rates, provides that, in case the corporate authorities fix unjust and unreasonable charges, the same may be reviewed and determined by the circuit court of the county in which the city is located. *Held*, that such section, in so far as it attempted to confer powers on the courts to review the reasonableness of rates so fixed, was in violation of Const. Ill. art. 3, relative to the distribution of powers of government, that the legislative function of ratemaking ended in the city council; and hence, alleged confiscatory rates having been adopted by a city ordinance, the water company, subject thereto, was not bound to apply to the local court for review before instituting injunction proceedings in a federal court of concurrent jurisdiction to restrain the enforcement of the ordinance, on the ground that it amounted to a taking of its property without due process of law. Where complainant water company claimed that a city ordinance fixing water rates was confiscatory, and, if enforced, would constitute a taking of complainants' property without due process of law, it was not bound to delay injunction proceedings until the ordinance had been in fact carried into effect and its confiscatory character demonstrated by actual operation, but was entitled to sue at once, assuming the burden of proving that the operation of the ordinance would necessarily be so confiscatory as to violate the federal Constitution.—Kankakee (Ill.) v. American Water Supply Co., 199 Fed. 757.

City Liable for Defect of Catch Basin Cover—Where a person passing along a public street on which there was no sidewalk was suddenly put to the necessity of stepping onto the curb by the approach of an automobile and in so doing stepped onto a catch-basin, the top of which turned and precipitated her into the basin, the city is liable for her injuries.—Colton v. Kansas City (Mo.) 145 S. W. 494.



ROADS AND PAVEMENTS

Inefficient Operation of Dayton's Asphalt Repair Plant

When the city of Dayton, in 1907, installed an asphalt repair plant of a well-known and excellent type, for the purpose of maintaining its asphalted streets, it acted wisely. But when it placed an incompetent man in charge of its operation, it acted unwisely and thereby defeated the purpose for the establishment of such a plant.

This proposition will be fully verified by the following account of its operation. The blame for the failure of the plant should not be shouldered onto the man in immediate charge, nor the superintendent of streets, nor the department of public service, nor the mayor. The entire fault does not lie at the door of any one of these four officials. The greater responsibility, however, for its failure should, in justice, rest upon the mayor and his appointee, the director of the department of public service, for both were men of larger experience than their subordinates, and should have seen to it that this new and important venture in street work had the right start. The citizens, who, by their votes, were responsible for their occupying these places of trust, had a right to expect that they would exercise good judgment in the discharge of every act in connection with the city's administration. The results show poor management, and they speak for themselves. No private business concern would have handled its affairs in such a negligent manner. So much for the blame; now for the story of the failure.

The plant was installed and equipped in the latter part of 1907, at an expense, according to the city auditor, of $13,-226.55.

The plant has been operated four years, from 1908 to 1911, inclusive. No permanent records have been kept during that period, with the exception of a loose record of materials purchased for operating the plant, and even that record does not show the source of supply, price or the total cost. The only facts and figures available for this article were found in the book referred to, the total appropriations for three of the four years in the office of the department of public service and the statement of the original cost of the plant from the city auditor. In addition, a few facts were obtained from the former superintendent of streets, included in his report for 1908, the only one made during the four years. No itemized account of the operation of the plant could be found anywhere, therefore it will be readily understood that only approximate values as to the cost of a square yard of repairs can be arrived at.

The following is a copy of the report of the superintendent of streets made to the board of public service, at its meeting, December 31, 1908:

"I herewith submit a detailed report of the municipal asphalt plant for the year 1908.

"Work on the repair of the asphalt streets was commenced about June 1. The plant was in constant operation the balance of the year, with the exception of about thirty days.

"The cost of running the plant was as follows:

Labor at plant	$ 7,844.43
Street labor	10,570.04
Oil	11.60
Louisville cement	71.00
Portland cement	140.00
Coal, 328,521 lbs	374.58
Tool repairs	84.05
Repairs at plant	355.97
Chemist	32.65
Stone dust, 960,000 lbs	2,328.00
Asphalt, 949,930 lbs	13,283.62
Sand, 9,035,200 lbs	5,239.37
Flux, 71 bbls	298.92
Pitch, 88 bbls	272.22
Printing, bond and advertising	166.75
Supplies	370.00
Lumber	242.68
Telephone	5.05
Electric power	382.76
Total	$42,073.69
Credit sacks returned	701.69
Net cost for the year	$41,372.00

"We have in the city of Dayton 446,800 square yards of asphalt pavement, or approximating 21.5 miles in linear measurement; 162,520 square yards, or 4 miles, of the above are still under the contractors' guarantee.

"All of the asphalt streets not under the contractors' guarantee were repaired and are now in first-class condition.

"During the year 46,832 square yards of asphalt repairs were laid, the maximum yardage laid in any one day of twelve hours was 465 square yards.

"At the beginning of this year the asphalt streets were in a deplorable condition, but the entire city has been covered so that today all the asphalt streets are in good condition.

"Most of the asphalt streets have been laid from twelve to fifteen years, necessitating constant repairing, and as the pavement gets older, more and more repairing is necessary. It is, therefore, evident that the annual appropriation for the street repairs should be gradually increased."

When asked how he was enabled to make out the report for 1908, the superintendent of streets said: "I had to figure it out from the accounts in the record book of materials."

"How could you tell anything about the cost of materials," he was asked, "when no record of cost was kept?"

"Oh, I had to get those figures from time slips, bills and memoranda," he replied.

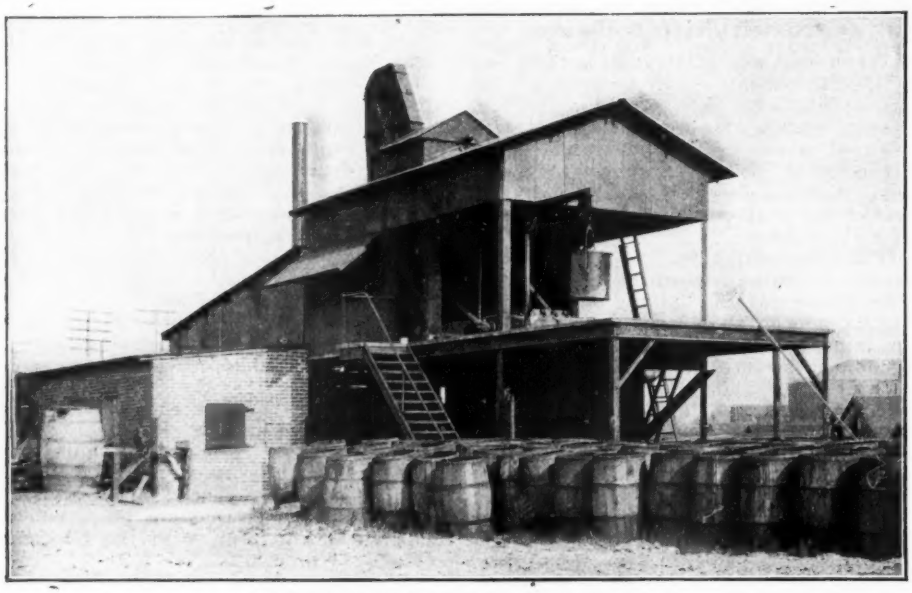
"What has become of those memoranda slips?"

"They were destroyed, I suppose."

"Were you not required by the board of public service to keep a complete record of the operations of the plant, so that you could tell at all times what the repairs cost per square yard?"

"No; the board did not think it necessary. Mr. ————, the expert accountant, who was one of the three commissioners, said it wasn't necessary."

From the figures in this report and



Municipal Asphalt Plant, Dayton, O.

ture" kept in the material record book, the square yardage of resurfacing and the cost per square yard can be arrived at roughly. The report for 1908 gives the total number of square yards laid that year as 46,832. The net expenses for the year amounted to $41,372. By dividing the net expenditures by the number of square yards laid shows that the average cost per square yard was 88.3 cents.

The total number of pounds of mixture used in 1908 totaled 8,269,501. Dividing this number by the total number of square yards laid shows that 176.5 pounds of mixture were used to the square yard on the average. Using these averages with the record of the total amount of mixture used each year forms the basis for the following table:

Year	Mixture pounds	Square Yards laid	Total cost year	Cost, Sq. Yd., cents
1908	8,269,501	46,832.0	$41,372	88.3
1909	5,392,225	30,550.8	.....	....
1910	7,198,805	40,786.4	20,000	49.0
1911	7,818,230	44,295.9	35,000	79.0

The account in the service department of the money appropriated for the plant this year was so mixed up with other street repairs that it was impossible to obtain the exact figures, so they are omitted.

If the figures given in the above table are even approximately correct, then it is evident that the plant was grossly mismanaged in 1908 and 1911, otherwise the cost per square yard would not have been 88.3 cents and 79 cents, respectively, for it is unreasonable to suppose that the cost per square yard in 1910 would have been so much lower than the other two years.

The showing is still worse when the statements of the superintendent in 1908 are compared with the facts in the table. In that report the superintendent said: "At the beginning of this year the asphalt streets were in a deplorable condition, but the entire city has been covered so that today (December 31, 1908,) all of the asphalt streets are in good condition."

Notwithstanding the deplorable condition found in 1908—presumably because they had been long neglected previously—and notwithstanding the statement of the superintendent that "all the asphalt streets had been repaired and were in first-class condition," 30,550.8 square yards were laid in 1909. And in 1910, 40,786.4 square yards were laid, only about 6,000 square yards less than were laid in 1908, when the deplorable condition prevailed.

The conditions must have grown rapidly worse, for in 1911, at an expense of $35,000, it was necessary to resurface 44,295.9 square yards—only about 4,000 square yards less than were laid in 1908.

But even with this large yardage laid in 1911, in September of that year many of the asphalt streets were full of holes, and by the 31st of December conditions were much worse. It seems strange that so many holes could be left when the repair plant worked seven months in the year, from May to November, inclusive, using 7,818,230 pounds of mixture in making the repairs.

Naturally, the holes did not grow any smaller as the weeks and months slipped by. When the new administration took charge of city affairs on January 1, the asphalt repair plant was not found in running order. The serious and prolonged illness of the new mayor, together with the necessity of breaking in a large number of newly appointed subordinates, are among the extenuating circumstances that hindered the new administration getting down to routine work. This is a fault in American city government that will be remedied some day. For the foregoing reasons and because it was claimed there were no funds to repair the asphalt plant until it was too late to do the work with the city plant, the director of public service decided to have the work done by contract.

But long before the contractor commenced work the citizens and press of the city set up a tremendous howl—and not without reason—about the frightful condition of the asphalt streets. It was freely stated on the street and in the papers that the asphalt streets had never been in such a "holy" condition, even in 1908, when the former superintendent reported them in a "deplorable condition," they were not as bad as public sentiment pronounced them last summer. So there was good reason for the people to howl.

Finally, in August, the belated work of repairing the streets was commenced. But even that did not quiet public clamor, for it was freely asserted that the contractor would run up an exorbitant bill against the city and make the work cost twice as much as it would if it were done by the asphalt repair plant. It was also asserted that the number of yards of repairs would "probably be double the amount of previous years."

Twenty-one days after the work commenced all the asphalt streets were repaired. The streets are in good condition today. The aggregate yardage was 15,526.8. By referring to the table showing the work of the asphalt repair plant for four years, it will be noted that the number of square yards laid that year amounted to more than three times as much as this year, when "everybody said that the asphalt streets had never been in such bad condition." The cost of the repairs this year amounted to $22,614.64, as compared with the cost last year, when the repair plant was used.

The average number of square yards of asphalt pavements repaired during the four years that the city plant has been used is 40,616.2, which is more than two and one-half times the repairs required this year.

The fault is not with the plant, but with the public servants who operated it. It is another case of municipal failure. But that is no reason for condemning the plant, nor jumping to the conclusion that an asphalt repair plant cannot be efficiently and economically operated by the city.

Dayton has spent its good money to install this plant, and it should demand that the present administration should use it in the future instead of employing contract labor. The present director of pub-

lic service is a man of many years' experience in the contracting field, and he now has a fine opportunity to perform a lasting service to the city by putting this plant in first-class condition and showing that a man of his experience at the head of such a department as his can perform unusual service to his city. Other cities operate similar plants at a profit to the city. What other cities have done, Dayton can do, especially thru its experienced director of public service.

[EDITORIAL NOTE. There are some discrepancies in the table of cost of running the plant, which could be explained only with the fullest information, which, it is stated, is not obtainable from the records. Thus the amount of sand used and the cost of sand, asphalt, limestone dust, etc., per ton are higher than the usual figures by 15 to 60 per cent. Some of these high prices may be justified, but no information is given on which to base a justification. Likewise the method of deducing the cost of repairs each year from the more definite figures of cost given in the report for 1908 is open to criticism, as is indicated by the round numbers in the total cost per year and the great fluctation in cost per square yard.

The cost per square yard in 1908 may be compared with the cost in other cities operating municipal asphalt repair plants at about the same period taken from data published in MUNICIPAL ENGINEERING, vols. xxxvii to xl.

Asphalt repair cost 83 cents a square yard in Indianapolis in 1909, including allowances for interest and depreciation, and 68 cents after profit on work done for asphalt contractors and others is deducted. The plant used is of the same design as that at Dayton. In 1908 the cost for street repairs was 64.2 cents a square yard. It was 52.4 cents when profits on outside work were deducted.

In Marion, Ind., in 1909 the cost, including depreciation and interest, using a small portable plant and with very few yards laid, was $1.024 per square yard, with an average depth of 2 inches.

In San Francisco in 1909 the cost of operation, apparently with no allowance for capital charges, was 95.6 cents a square yard.

In Brooklyn, N. Y., in 1909 the cost, including interest and depreciation, was 68.3 cents per cubic foot for wearing surface, or $1.024 per square yard 2 inches thick, or 76.8 cents per square yard 1½ inches thick.

In St. Joseph, Mo., in 1909 the cost was 86 cents a square yard.

In Detroit the cost in 1909 was 85 cents, a reduction from 94 cents in 1908 for resurfacing; 80 cents for repairing and 93 cents for patching. In 1910 the cost for resurfacing, including depreciation and interest, was 93.6 cents, or 92.3 cents, with credits for outside work made; 93.2 or 85 cents for repaving; and $1.031, or 93.1 cents for patching, with and without credits, respectively.

The figures of cost for 1908 for asphalt repairs in Columbus, Indianapolis, Detroit and Marion are reduced to a common basis and compared in MUNICIPAL ENGINEERING, vol. xxxvi, p. 169, and for thickness of repair coat of 1½ inches do not differ materially from the figures given above.

It is evident, therefore, even from the meager information concerning the Dayton plant which is at hand, that its asphalt plant was not unduly expensive. An independent inspection of the plant by an expert resulted in the report that the plant is in good condition for work, requiring only such small replacements and repairs as are always needed in putting a plant in operation. The abandonment of the plant seems, therefore, to have been a mistake, which, it is believed, may be attributed to the ignorance of the new city officials regarding the matter and their neglect to secure unbiased expert advice before deciding what should be done.

Figures for 1912 for Niagara Falls may be added, being a report for the first year of operation of a small portable plant. In all 12,243.9 square yards of asphalt surface were laid, costing $12,148.05, including the plant and work done on other pavements. Deducting the cost of plant and repairs to other pavements and adding 30 per cent of cost of plant for depreciation the cost becomes $9,414.21 or 76.9 cents a square yard. Deducting the amounts paid by contractors for asphalt repairs the net cost to the city was 54.5 cents a square yard. A plant with a capacity of 500 square yards of 2-inch asphalt per 8 hours is recommended for next year, the success with the small plant has been so pronounced.

An Expensive Indiana Road

What is conceded by road builders to be the biggest contract let in Indiana under the three-mile road law during the life of that statute was the improvement of the Walnut Tree pike, at Wabash, Ind., which serves as the southern approach to the Wabash street river bridge. The contract was awarded to Conover & Taber and over twelve months of continuous work was required to complete the task. To make a better approach to the bridge a roadway was cut thru a bluff from the top of which it is 57 feet to the roadway at the highest point. From a cut of 20 feet from curb to curb below the excavations widened to 110 feet at the top. An excellent spring was found thirty feet

below the surface of the rock and the water was piped 100 feet to a fountain. W. P. Fowler was the engineer in charge of the contract, which was awarded on a bid of $68,000.

Road Construction in Wayne County, Michigan

The board of county road commissioners of Wayne county, Michigan, has now been at work for six years and is showing some remarkable results. One reason for this is suggested by the fact that the report for the year ending September 30, is prepared, printed and distributed before the close of the calendar year. This means close personal attention to the work by the members of the board and an efficient organization. With a varying force, sometimes as large as 1,000 men or more, organization is absolutely necessary, the work must be specialized so that each man will be put where he is most efficient and merit must be the only consideration in employing and retaining officers and men.

Concrete Roads.

Wayne county is noted for its concrete roads, some of which have now been in use for nearly four years, and their success is such that this type has been adopted as the standard for the county. Over 65 miles of concrete road have been constructed in the past four years, more than of all other materials together. Under county board supervision the mileage of roads constructed in the six years' life of the board is as follows:

Concrete	65.745 miles
Gravel stone	13.500 miles
Brick	9.759 miles
Tar macadam	9.348 miles
Water-bonded macadam	7.500 miles
Gravel	4.869 miles
Bitulithic	3.000 miles
Creosoted block	2.000 miles
Rock asphalt	0.500 mile
Total	116.221 miles

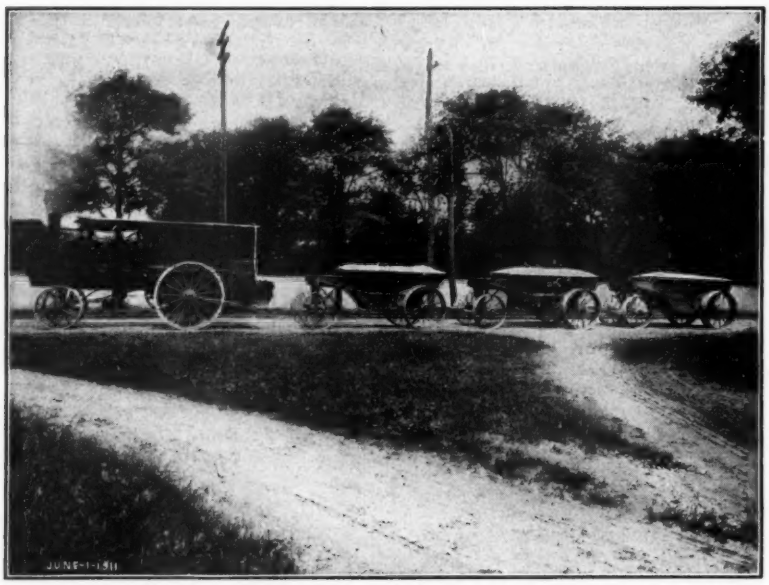
This is less than 10 per cent of the 1,375 miles of road in the county outside of cities and villages. The township road commissioners are also active in the improvement, but more particularly in the maintenance of the roads within their townships, and under the advice and with the assistance in engineering matters of the county road commissioners they are bringing up the neighborhood roads to condition acceptable for feeders of the main roads.

An Example of Wayne County, Mich., Roads Before the Commissioners Began Their Work.

Main Roads to Be Built.

It is the intention to build ten main roads radiating from Detroit to the county line in all directions. The usual difficulty in connecting the paved city street with the paved county road, thru the less valuable property within the city limits, but on the outskirts, is experienced.

The county road law was passed orig-



Hauling by Steam. Each Wagon Contains Seven Tons of Stone or Sand and on an Average Length Haul Will Make as Many Trips a Day as a Team if the Subgrade is Dry. The Bulk of Wayne County Road materials and supplies are hauled in this manner.

inally in 1893, and has been used but little until the past five years or so, the adoption of the law by a county being subject to a vote on a petition of 10 per cent of the taxpayers. Under it the board of county road commissioners is established, roads are taken over as county roads, new roads are laid out, and these roads are improved. The county board of supervisors levies such taxes as it sees fit, within the limits set in the law, on due receipt of the recommendations of the road commission. The supervisors may make their appropriations as a whole or for any parts of the detailed recommendations made by the road board.

Funds for Road Improvement.

The funds for road improvement come from three sources: (1) The county road tax, which, in Wayne county cannot exceed 50 cents per $1,000. This tax was 48 cents for 1911 and about 6 cents for 1912. No tax is recommended for 1913, the bond fund being sufficient. (2) The sale of county road bonds, authorized by general vote in 1910, $200,000 for 1911, $500,000 each for 1912, 1913 and 1914, and $300,000 in 1915, or $2,000,000 in all. The principal and interest are provided for by a small tax and the last bonds mature in 1931. (3) The state reward, which is $1,000 a mile on concrete or macadam roads, $750 a mile on gravel-stone roads and $500 a mile on gravel roads constructed under specifications approved by the state highway department.

The Story of a County Road.

When a road is taken over as a county road, it is given a name, usually the one by which it is known to the general public. A survey, plans and profile are then made and filed with the state highway department, together with a copy of the specifications and an application for state reward, after which the subgrade is prepared and shaped, rolled hard with a 10-ton roller, and the concrete laid on the natural subsoil. Side rails of 2x7-inch lumber are used, and these are protected on top by a 2-inch angle iron. When the concrete has become sufficiently firm to permit the removal of the rail, the finishers pare off the outer edges which are formed next to the rails, to prevent a sharp, dividing line between the concrete and the gravel shoulders.

Trunk roads are built 16 feet wide, with gravel or limestone shoulders 4 feet wide on each side. The lesser traveled roads have 12 or 15 feet of concrete with a minimum width overall of 24 feet. Concrete roads 10 and 18 feet wide have also been built.

The concrete is put down wet, so that no tamping is necessary after it is placed. When this is done no workman is permitted in any way to disturb the concrete by stepping in it or throwing anything on it. The strikeoff men use a plank trimmed to the curvature of the road and iron bound on the lower edge. It rides smoothly on the iron edges of the form

boards, or rails, at the side of the concrete, and is handled with sufficient care to eliminate the necessity for any considerable floating by the followup men.

These floaters work on a bridge which rests on the form planks at the edge of the road, so there is never any contact with the concrete. This rule to keep off the concrete is rigidly enforced. Smoothing is done with simple wooden floats of home manufacture.

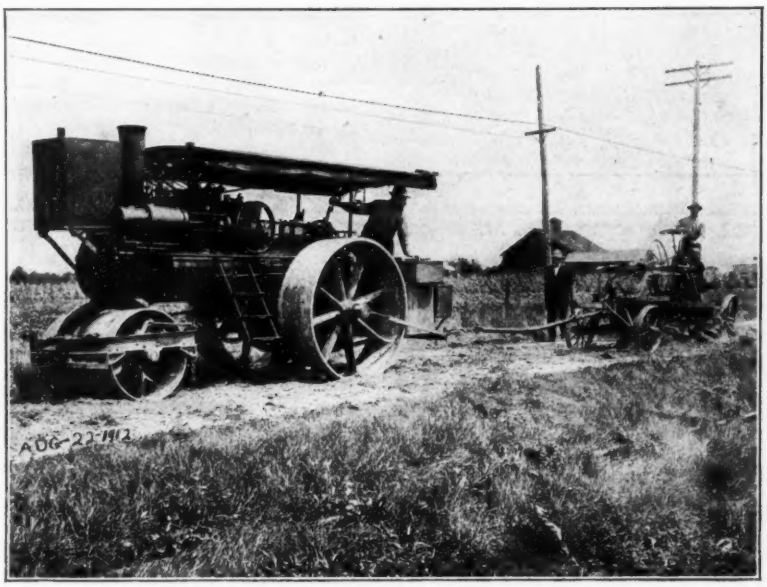
Each day's work is finished up to an expansion joint, and no more than 20 minutes is permitted to elapse between batches during the day. The work of the day is covered with canvas, and the next day the canvas is removed and the concrete covered to the depth of about two inches with any sand or loose soil that may be available to keep the concrete from drying out too rapidly. The concrete is sprinkled continuously for eight days. Roads are not opened for traffic until at least two weeks after the last concrete is put in place.

The gravel or stone shoulders are put on in layers 3 inches deep and rolled with a 10-ton roller. This work is not started until the adjacent concrete is at least three weeks old.

Machinery is used wherever the same or a better result can be secured, and it is a unique spectacle to see the large hauling engines of the commission training from two to four large wagons, each loaded with 7 tons of stone. Graders are also drawn by steam, doing the work of 6 to 8 horses, and doing it more efficiently and more rapidly. Old roads are rooted up with a scarifier or gang plow. Water is pumped for miles by gasoline engines. Stone and sand on some of the roads are unloaded with a steam grab bucket, and many smaller economical and labor-saving devices designed by the commission or its employes are in use. Cement is mixed in a mechanical batch mixer that moves under its own power, and from which a boom projects, capable of being swung in the arc of a semi-circle. The mixed material is dumped into a bucket which is run out on the boom and deposited on the road where wanted. Each batch of concrete is turned over three complete revolutions dry before water is added. A wet mix is used.

Hauling materials to the road to be used (as the mixer and gang work backwards towards the base of supplies) is done with considerable nicety, so that it is usually unnecessary to haul in extra sand or pebbles to make a properly proportioned batch.

The subgrade is thoroly wet before any concrete is placed on it in order that the water will not be absorbed from the concrete. The roads are built in 25-foot sections, with a protecting plate 3-16-inch thick and 3 inches wide at each contraction joint. These metal plates are intended to protect the edges from spalling and chipping. They are shaped to conform to the crown of the finished road, which is ¼ inch to the foot. Two thicknesses of asphalted felt (about ¼ inch) are inserted between these metal



Grading Behind an Engine. An Economical Plan.

plates, cutting the entire depth of the concrete. These plates are provided with shear members which tie them securely to the concrete. They also enable us to secure a more even and uniform surface to the road. The accompanying pictures will give a general idea of how the work is carried on. With the scarcity of labor willing to go into the country districts and work, results would be much less impressive and the costs a great deal higher without the various labor-saving devices used.

Machinery Used.

In all of the work done by the board of county road commissioners the highest grade material and equipment were used thruout.

The Port Huron Engine and Thresher Company of Upton Works, Mich., supplied a large number of the heavier machines, such as traction engines, road rollers, scarifiers, dump wagons and tank wagons.

The Austin Western Company, limited, of Chicago, furnished road graders and scarifiers.

Pumps and pumping engines were furnished by Fairbanks, Morse & Company of Chicago.

The Western Wheeled Scraper Company of Aurora, Ill., manufactured some of the graders used and a considerable number of smaller machines and equipment, such as scrapers, road drags, tool wagons, etc.

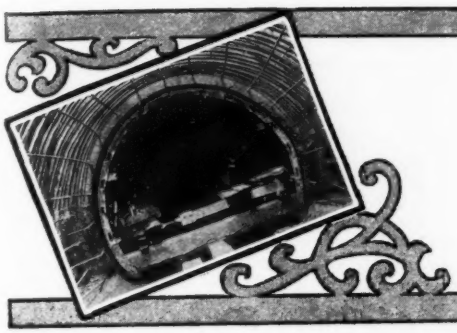
Universal Portland cement was used thruout and practically all of the roads were reinforced with the special reinforcement of the Thomas Reinforcement Company of Detroit, Mich.

Baker joints and contraction plates were used for insuring even joints.

Road Construction in Rush County, Indiana

During 1912 Rush county, Indiana, constructed 200,730 feet of gravel and macadam roads at a cost of $190,191.50. This is practically 38 miles of road at $5,000 a mile, almost exactly. Gravel roads cost $3,510 per mile; macadam cost $5,947; macadam with gravel top cost $5,436, and water-bound macadam cost $5,380. Contracts were let for nearly 28 miles more of road, which will be constructed next season. About 40 miles more of roads have been petitioned for, but have not yet been let. Most of the petitions are for macadam or gravel, but one is for macadam and brick; three are for bituminous macadam, and one may be built of concrete. Adolphus Cameron is the county surveyor and William Dill is the deputy, who devotes himself to the roads.

IRRIGATED TREES
on Jackson Boulevard, near downtown district, Chicago, and cared for by the West Chicago Park Commission.



SANITATION

Municipal Plants for Electrolytic Sewage Purification

By C. L. Edholm, Los Angeles, Cal.

TWO enterprising Western municipalities have adopted a modern system for purifying sewage by electricity and are thoroughly satisfied with the modern method of eliminating the odor and destroying the disease germs therein. One of the plants is at Santa Monica, Cal., and it has been in operation since 1908 with complete success. The other is at Oklahoma City, Okla., where a plant was installed to take care of 750,000 gallons of sewage in 24 hours. This was found so efficient that a second plant has been ordered and is now under construction for use in the "packing-house district," where three times the amount of sewage and slaughter-house refuse will be electrolytically treated. The present outlet is into the river below the city and constitutes a serious nuisance, which will be abated by the new system.

The value of the electrolytic process has been demonstrated at Santa Monica. The city's sewage is discharged into the sea from the end of the municipal pier, a pleasure resort in the best part of the city. Raw sewage thus disposed of would be offensive to all visitors to the pier and would depreciate values for adjacent beach lots. With the deodorising process in use, however, the average frequenter of the pier is unaware that there is a sewer in the neighborhood, and the nearby property is a most attractive residence and apartment house section. For a few days, the plant was shut down and the difference became extremely noticeable; complaints followed thick and fast from residents and visitors, and did not cease until the operations were resumed.

Although its presence is not advertised, visitors are welcome to inspect the Santa Monica plant, and even a casual inspection is of interest. The sewage is treated in an underground chamber, built at the end of Colorado avenue where it enters the municipal pier. Only a flight of concrete stairs, leading from the sidewalk to the room under the street indicates that there is anything of the sort below the street level. The stairs lead to a concrete chamber about fifty feet long, divided by a wooden partition into two rooms, the first containing the electrical apparatus, motor, switchboard, etc., while the second contains three open troughs thru which the sewage of the city is flowing. Yet the air in that unventilated chamber is as clean as the atmosphere above ground. The secret of this is the series of electrodes, ten in each flume, around which the sewage flows. They are composed of metal plates, 9x24 inches and 3-16 of an inch thick, set upright and half an inch apart. There are 29 such plates to each electrode. The flumes are 30 feet long, 22 inches wide and 18 inches deep, and the sewage is admitted to them by gates at the upper end and flows slowly to the outlet at the lower end, whence it enters the discharge pipe that conveys it to the sea. In flowing between the plates of the electrodes, this liquid is subjected to the influence of an electric current of about 2 volts and 800 amperes, and to the chemical action caused by the decomposition of the plates of the electrodes.

Raw sewage flowing through these troughs is treated with electricity deodorized and rendered innocuous.

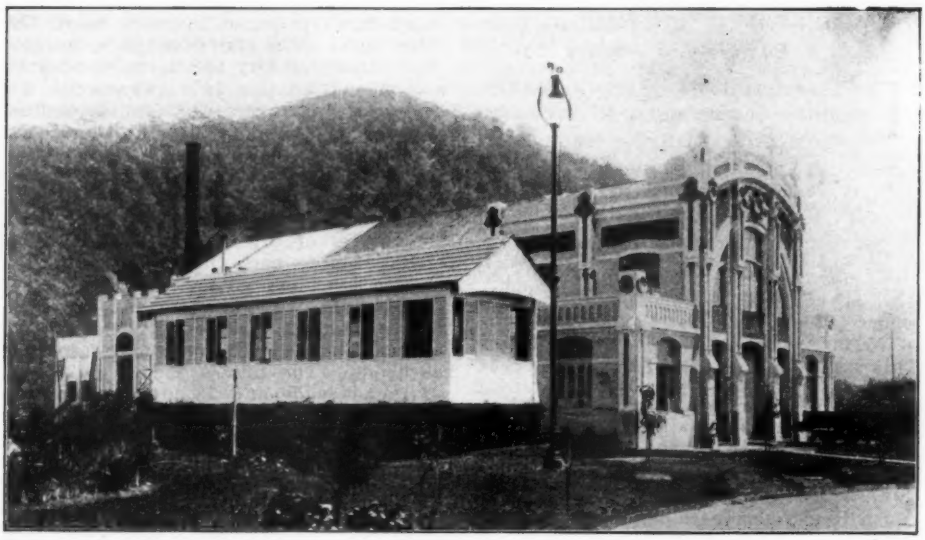
The chemical action is stated concisely by Howard V. Hinkley, consulting and supervising engineer, Oklahoma City, in a recent report:

"The process is electro-chemical. Oxygen, hydrogen and chlorine are liberated in the nascent state; are powerful reagents and render the effluent neutral —a result not obtained by either chemical or biological treatment. Owing to the oxidization no traces are left of albuminous or nitrogenous bodies, which give so much trouble in the way of secondary putrefaction in the septic treatment. Nitrites are changed to nitrates and the iron and copper compounds coagulate and clear the effluent. The oxy-chloride of lime and magnesia destroys dangerous (including typhoid) bacteria, while the free sulphuric acid generated in the process kills cholera germs, if present."

The valuable fertilizing properties of sewage are not lessened, but rather increased by these changes, and while the plants now in use allow the treated liquid to run to waste, there is no doubt that use will be made of this water for irrigation and fertilization in other cities where conditions are favorable. This would be of special value in semi-arid sections where water is at a premium, and where the science of irrigation is well understood. In this way, the cost of operating such a plant may be repaid by the sale of the treated sewage.

The cost of installing the Santa Monica plant was $10,000, while the one at Oklahoma City was built for $12,000. The one under way in the latter city will cost $45,000.

The cost of operation will vary in different cities, according to cost of current, wages of attendants and topography of the city. For instance, a pumping plant must be maintained at Santa Monica to raise the sewage from a reservoir to the forebay which discharges into the flumes, but in other places this might be avoided by constructing the flumes on a lower level than the reservoir. The table which follows is from the Oklahoma City report, above referred to:

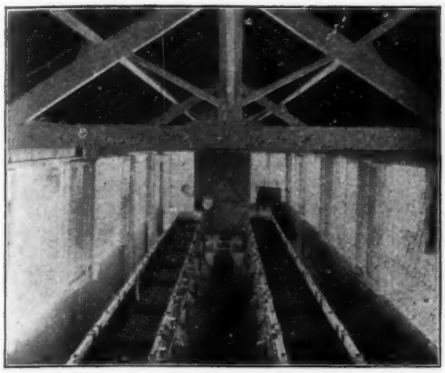


The large building is the electric power plant of Santa Monica, Cal. The smaller building on the left with the numerous open windows contains the apparatus for electric treatment of sewage.

	Per Annum	Per Million Gallons
Electrical current	$709.50	$2.59
Attendant	660.00	2.41
Lights	40.00	0.15
Total operating	$1,409.50	$5.15
Renewal of plate	200.00	0.73
Depreciation of electric machinery	100.00	0.37
5 per cent. on investment	800.00	2.92
Total operating and fixed charges	$2,509.50	$9.17

The interest was computed upon the sum of $16,000, of which $1,000 is for attendant's house and $15,000 for the cost of the plant. The actual cost of the plant was only $12,000, but this was built at a low price in order to demonstrate what it could do. Such a plant would cost $15,000 at the regular price.

It will be noted that only one attendant is required, who receives $660 per



Looking down on electro sanitation equipment. View from opposite end of building as shown in preceding photograph.

annum and use of house. This indicates that very little labor is required, and it may be added that one man could attend to several similar plants, if conveniently located, as they require only a few minutes work each day. The cleaning is accomplished by means of a double-throw switch, which enables the operator to reverse the current. An occasional washing of the flumes and plates with a garden hose completes the cleansing process.

In referring to the low cost of installation and upkeep, it may be stated that considerable reduction of expense per million gallons would be possible in the operation of large plants, such as would handle the sewage of a great city. The inventor claims that no less than 50 per cent reduction could be made. Compensation for the initial outlay would result from the fact that lands now made almost worthless by the proximity of sewer outlets, would no longer be undesirable, and would increase in value. Of course, the benefits to the community from a sanitary standpoint by a purification of the sewage that removes the germs and odor, are too obvious to require comment.

The power plant and grounds give evidence of care in designing with reference to appearance, and the sewage disposal plant itself is not objectionable, tho a little more attention to conformity of its design with that of the adjoining building would have produced a better appearance.

Commission Form Barely Wins

The city of Ottumwa, Ia., has adopted the commission form of government by a vote of 1,351 to 1,275.

Garbage Reduction in Chicago

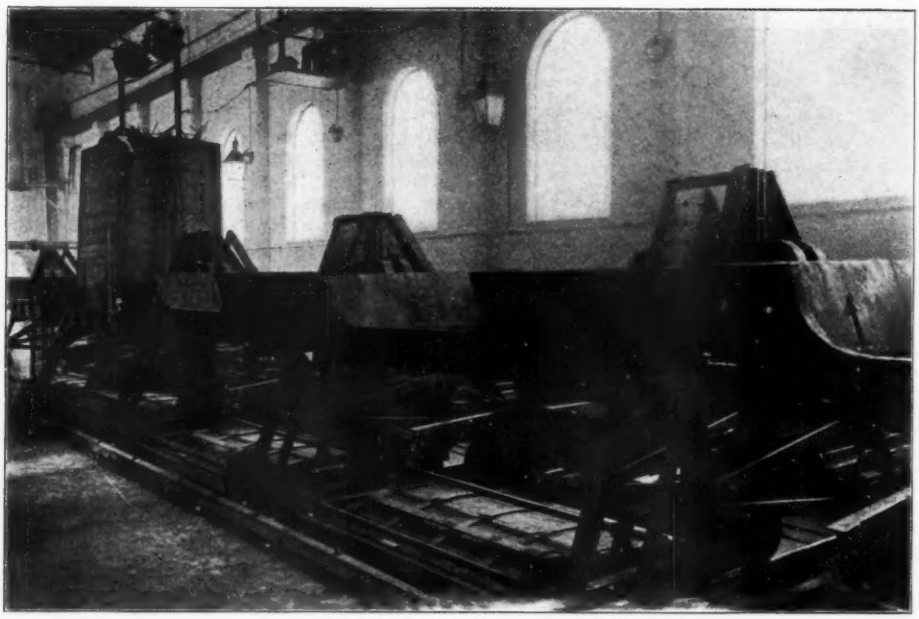
Until six years ago, Chicago followed the primitive and unsanitary custom of dumping all its garbage in clay holes within the city limits. This practice created such an unbearable nuisance in the localities adjacent to these city garbage dumps that in 1905, Joseph Medill Patterson, then commissioner of public works, vigorously called the matter to the attention of the city council by a report which recommended that the city's garbage be disposed of by the reduction process.

On May 14, 1906, the city council ordered the commissioner of public works to advertise for proposals for the final disposition of garbage. In response to advertisements five bids were received. One of these was submitted by O. M. Bake, Walker P. Hall and J. P. Christian, who offered to dispose of the city's garbage in accordance with the specifications for the sum of $47,500 per year. Two months later the city directed the commissioner of public works to accept this bid. On August 30, 1906, the commissioner of public works executed a five-year contract with the Chicago Reduction Company, a corporation formed by the successful bidders and other persons. Before the contract was executed it was assigned by Bake, Hall and Christian to the Chicago Reduction Company.

The city council on June 29, 1908, passed an ordinance directing the commissioner of public works to enter into a new contract with the Chicago Reduction Company for a period of five years, ending September 1, 1913, upon practically the same terms.

The city of Chicago collects its own garbage, hiring teams by the day to haul its garbage wagons. The garbage of the west and north sides is hauled to the loading stations at Oakley avenue and at Chicago avenue, whence it is conveyed by boat at the city's expense to the plant of the Chicago Reduction Company at Thirty-ninth and Iron streets. Most of the south side garbage is hauled in wagons directly to the plant. On account of the distance, the garbage of the eighth and ninth (old thirty-third) wards is not conveyed to the Chicago Reduction Company's plant, but is deposited along with ashes and rubbish on a city dump near Fifty-ninth and Yates avenue. It it admitted that garbage from the thirty-fifth ward is dumped near Riverview park, and that vegetable refuse from South Water street is dumped at Forty-seventh and Robey streets and elsewhere.

The plant of the Chicago Reduction Company is located at Thirty-ninth and Iron streets, a distance of 4¾ miles to the southwest of the center of the city.



Top of refuse destructor showing frames over openings to cells, the cell covers closed and at the left of the box full of refuse lowering into position to dump with the cell.

Steam roads reach the plant of the Chicago Reduction Company thru the Belt line.

The Chicago Reduction Company has a frontage of 380 feet on the Chicago River, and by laying a short distance of track will be accessible also by street car lines to the city. This furnishes transportation facilities by water, steam railway, electric car or vehicle.

The principal buildings are of a modern and permanent construction, being built of brick and reinforced thruout, well lighted and ventilated, making them fireproof and sanitary, and representing an outlay of a vast sum of money. These buildings are equipped with patented and modern machinery, especially designed to handle the inconsistent mass of pure garbage, completing the process of sterilization, reduction and disposal from start to finish within a few hours from its delivery. They are shown in the accompanying birdseye view, which shows the plant from the land side, where wagons drive up, are weighed and driven to the left for unloading in the building at the left back corner, not shown in the birdseye view, but seen in the photograph showing the handling of the garbage as it arrives.

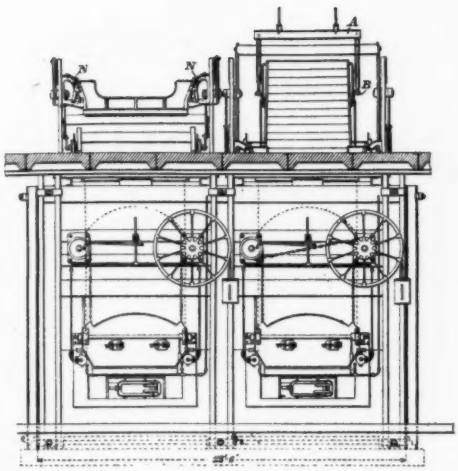
The large building on the right is the extraction plant. The mill building, the grease tanks and scale house, condenser house, naphtha plant, power house, office, etc., follow in about the order named, toward the left. The receiving, sorting, pulverizing and drying buildings are at the extreme left.

The present capacity provides for 700 tons of garbage daily, but the present city deliveries are only averaging about 350 tons per day, and about 200 tons of pure garbage are still being daily scattered in open dumps.

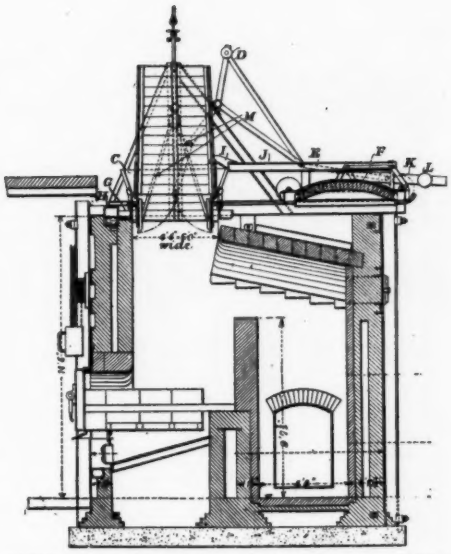
The sanitary district of Chicago furnishes motive power for all machinery.

The garbage is delivered to the plant in sanitary, closed steel boxes and wagon beds on the road, and scows on the river. In the future the boxes may be conveyed by steam railway or by electric street cars from the outlying territory at a very nominal cost to the city. The boxes are hoisted from the scows or wagon boxes by derrick, and their contents are then dumped to moving platforms, which convey them into the receiving buildings, where all foreign matter such as metal, cans, wood, paper, etc., is eliminated by hand picking. After the boxes are dumped they are swung back, cleansed and sterilized in a large deep steel vat.

The garbage leaves the receiving building after being thoroly crushed in pulverizing machines, and a series of conveyors delivers this crushed garbage automatically into the hot-air dryers. In all there



Front of furnace showing feeding box above, and frame of cell cover. Below are stoking doors and clinker doors beneath them.



Section thru destructor cell showing box above with gates open to dump, mechanism for opening and closing cell cover, section of grate and combination chamber.

are ten dryers, eight of which are six feet in diameter and forty feet long, and two are eight feet in diameter and seventy-five feet long. Crude oil has been adopted for generating the heat necessary for drying, thus eliminating all obnoxious coal, smoke, ashes, etc. The daily consumption of oil is about 14,000 gallons. This process of drying eliminates about 75 per cent of the moisture carried by the garbage.

The modern condenser house, thirty feet wide, forty feet long and sixty feet high, together with three concrete stacks six feet in diameter and 200 feet high, completely absorbs all gases and vapors of the steam coming from these dryers.

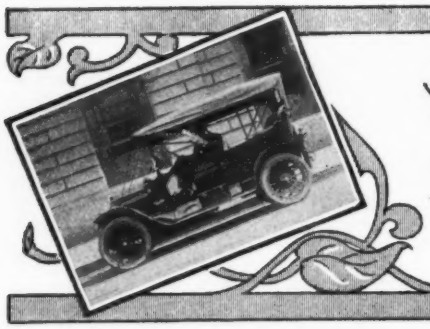
After the garbage has been pulverized and dried, it is then delivered to the naphtha plant, where same is treated with gasoline in order to separate and recover the grease contained in said garbage. The process of recovering this grease is expensive and requires skillful help. After the grease has been extracted from the tankage, it is re-dried in another set of dryers, using crude oil as fuel, and is then ground in the mill, and from these shipped to the fertilizer trade, where garbage tankage has found a market as a filler for fertilizer.

A set of boilers installed in the power house furnish steam used in connection with the naphtha extraction process and the driving of hoisting engines.

The Chicago Reduction Company, whose present contract with the city of Chicago expires in September, 1913, has, thru its president, W. A. Julian, recently made and advertised a garbage offer, which, in part, reads as follows:

We will execute a contract with the city, giving suitable bond, to handle the garbage of the city for a period of five years similar in terms and conditions to our present contract, except with a reduction in the bonus to be paid us of $17,500 a year, making the amount to be paid us by the city $30,000 per year, or $150,000 for the full period of five years, instead of $237,000, making a saving to the city for that period of time of $87,500.

Or, we will make a contract with the city to continue to handle its garbage at our present site for a term of five years, by the terms of which the city will pay us $90,000 per year for that period of time, and at the end of the contract we will turn over to the city our plant, with such enlargements and improvements as shall be made, so that the city will then own this plant with a fee simple title to the land (3½ acres) and its improvements clear of all encumbrances.



Automobiles in Municipal Service

Automobile Pay Car for Detroit City Employes

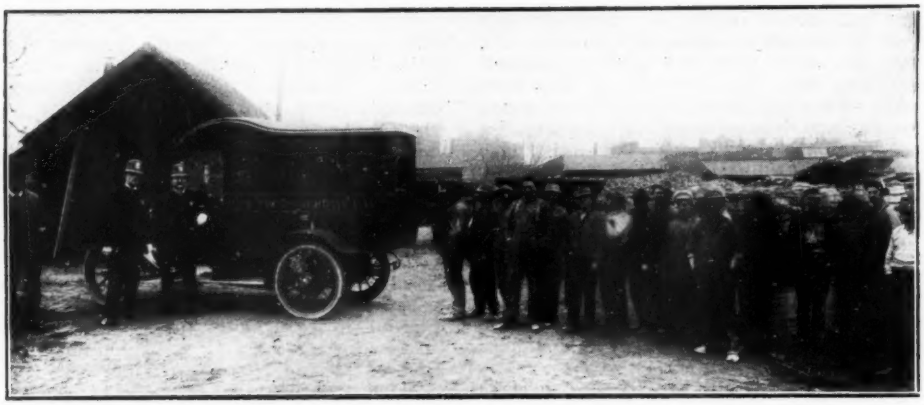
The idea for an automobile pay car suggested itself to the Cartercar Company as a result of the waylaying of an elderly officer of the Detroit police force, who was knocked down and robbed of several thousands of dollars in broad daylight a few months ago. This money was for the pay of the city employes. The car shown in the photograph is kept at the Cartercar garage and is driven to the city hall at 8 o'clock every Wednesday morning. When the paymaster is ready to make his rounds, he and the police officers ride off in the car and when thru, leave it in front of the city hall to be called for at night by a driver from the garage. This makes it cost the city a small sum for upkeep expense.

The entire car is built on the regular Cartercar chassis. It has a friction transmission, which enables it to be handled very easily and quickly. There is an unlimited number of speeds which makes it very desirable in travelling in out-of-the-way parts of the city. The entire car presents a very handsome appearance and is such that it is a credit to the city.

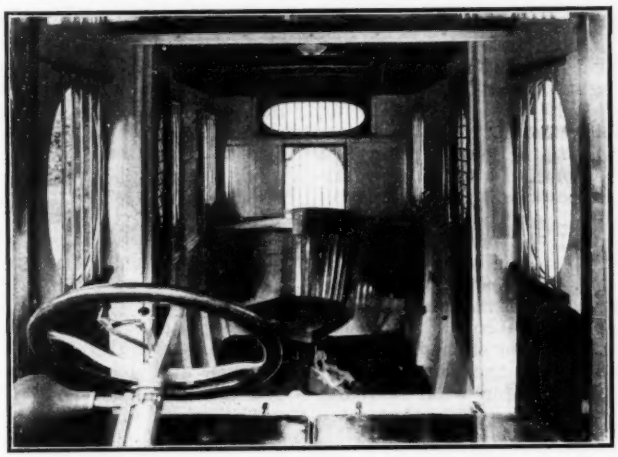
Two police officers are detailed to go with the paymaster each Wednesday. One of these officers drives the car and the other rides beside him at the left. The front is the only possible access to the funds and with the two bluecoats riding there, there is very little danger of a holdup.

The second photograph shows the office arrangement of the interior. The latticed doors at the front of the car have been swung back and the back of the front seats turned down so that a good view of the interior of the car can be taken. The revolving office chair and desk are clearly shown. The desk is arranged on a level with the pay window at the back of the machine. At each side are three drawers, arranged in sections so that the pay envelopes can be placed in them numerically. The window from the outside comes so it is about even with a man's head, making it impossible for him to see into the drawers where the pay envelopes are kept. A large number of envelopes can be arranged in these drawers and found very quickly, making it possible to pay a long line of men with little difficulty.

The three windows at each side of the car are covered with bevel plate glass and brass bars on the inside insure further security.



City of Detroit Pay Car Showing Method of Paying City Employes.



Interior View of City of Detroit Pay Car.

Economy of Motor Fire Apparatus in Springfield, Mass.

No more convincing proof of the great superiority of motor-driven fire apparatus over horse-drawn types can be cited, both with respect to efficiency in preventing fire losses as well as in the actual saving of departmental expense, than the recent report submitted by the chief and fire commissioners of Springfield, Mass.

There are now 22 pieces of motor-driven fire apparatus in the service of the department and a very interesting comparison is shown by reference to the report of 5 years previous when the city had only three motor-driven machines, consisting of a combination hose and chemical and two chief's cars.

The number of alarms answered by the department in 1907 was 498 with a property loss of over $535,000, while in 1912 829 alarms were responded to with a total loss of only $166,000.

Although one bad fire was responsible for a large part of the loss in 1907, it is nevertheless plainly evident that the increase of motor-driven apparatus in recent years has enabled the department to take care of a much greater number of fires, with far less property loss than would have been possible with the old horse-drawn equipment.

Further important facts are revealed as regards the saving in upkeep cost by comparing the reports of 1911 and 1912. The total expenditure for the latter year amounted to a little over $239,000, and included, in addition to current expenses, four large pieces of motor-driven apparatus, a new up-to-date fire house and an increase of 32 new men to the pay roll. In spite of unusual expenses and the added fact that 100 more alarms were responded to during this year than in 1911, a saving of nearly $8,200 was made the previous year's budget; surely a very strong argument in favor of motor-driven apparatus from the standpoint of upkeep cost alone.

Chief Daggett sums it all up in a terse phrase when he says "Motor-driven fire apparatus is without question one of the best investments any city can make and will pay handsome dividends in the saving of property, as well as in economy of departmental expenditures."

The Half-Ton Truck

The Mercury truck, manufactured by the Mercury Manufacturing Company, Chicago, meets the requirements of many municipal departments having use for a motor-driven truck of 1,000 pounds capacity. City engineers, department commissioners and park superintendents constantly find it necessary to transport tools and supplies from one section of the city to another. Such work must be done in speedy fashion, and for such purposes horses are too slow and trucks best suited for heavy hauling are too expensive.

Health, meter, lighting and water departments have many uses for the light truck, also engineering departments, bridge building, paving and sewer inspectors and municipal contractors.

The labor of horses has long been one of the expensive items of municipal department maintenance. In order to have motive power available during the busiest seasons of the year the municipality has been compelled to feed and house horses thru several months of practical idleness. Taking eight hours as an average day and three hundred working days, figures show that the average municipal horse works only one-third of the work-

ing time and is idle two-thirds. Municipal officials are learning what it costs to do their light hauling with horses, and trucks of light capacity are being rapidly installed thruout this country and Europe. Many of those officials who have kept records between the cost of operating half-ton trucks and the number of teams necessary to do the same amount of work assert that the entire investment on the machine can be written off the books within 1½ to 2 years, and these conclusions have been reached without figuring the saving on account of a greatly reduced operating and storage expense. This saving is due to the fact that the muncipality is paying for what it really gets and really makes use of in the motor truck.

The cost of fuel to operate a light truck when running is less than the cost of horse feed for horses to do the same work and then this truck requires no fuel on Saturday afternoons, Sundays and holidays when it is not running. Horses eat on Sundays as well as on any other day. There is also a saving in men.

A Well Drilling Tractor

The Armstrong gasoline tractor driller, made by the Armstrong Manufacturing Company, Waterloo, Iowa, contains a number of features which are appreciated by contractors and engineers.

The two speeds ahead and two reverse are obtained without the use of the usual train of gearing. The simplicity of the transmission gives the highest possible efficiency while running on either high or low gear.

As a rule, it is a matter of too much power for operating the drill in actual drilling work, or not enough power to pull thru heavy roads, up a steep hill or out of a bad hole. If you have too much power for drilling it means that you are using more fuel than necessary all of the time you are drilling, in other words, a part of your profits are being constantly and needlessly wasted in fuel in order that you will have power enough to move your machine; and remember that from 95 to 98 per cent of the time you are drilling that is where you get your profits and profits increase as cost of operation decreases.

You buy a tractor, to be independent of horses for moving, to cut out the expense of feeding horses that are used only occasionally, to decrease your moving expense, to save time; in other words, to increase profits.

If you do not have sufficient power for moving (and that means on good or bad roads—roads that would be passable for horses) you are only increasing your investment, your cost of operating, your necessary delays, and in place of increasing profits, you are decreasing them.

A man operating a traction machine does not want to find it necessary to call on his neighbor to pull him out with a team or several teams of horses. This expense and delay is unnecessary if the proper equipment is purchased.

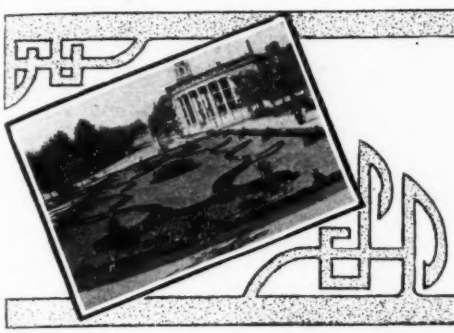
The power of the engine is transmitted to the clutch and from the clutch thru two short drive chains to the counter or drive shaft in the transmission frame (the two chains being provided with the different size sprockets to obtain the required two speeds).

This gives an efficient, flexible and noiseless transmission without the use of the usual number of gears. The chains are of brushed steel roller type. The links are of steel with case-hardened bushings and pins and having rollers of a special malleable iron to withstand wear and heavy shocks.

One lever controls the operation of the friction clutch and the friction brake. This lever engages the friction clutch when thrown forward and operates the friction brake when thrown backward. With this arrangement it is impossible to throw the clutch in while the brake is on and also allows the operator to apply the brake instantly when the clutch is released. This eliminates the danger of breakage and all unnecessary wear and tear on the machine.

Convicts as Road Buliders

The highway improvement convention, held at Springfield, Ill., January 31, under the direction of the Illinois Manufacturers' Association, discussed the question of the employment of convicts on roads. They have been employed in that state in preparing materials for making roads, and men prominent in Illinois labor circles think they should also work on the roads themselves. The warden of the Joliet prison is strongly opposed to the project.



CIVIC BEAUTY

Effect of Parks and Playgrounds on Real Estate Valuation

The great movement towards civic betterment which has during the last decade occupied more and more of the attention of municipalities, has in America unquestionably taken as its central idea the acquirement of land and its development for park purposes. Many of the so-called city plans are devoted well-nigh exclusively to the discussion of a park system, while some go further to include only the civic center, overlooking the essential factors of utilitarian nature, which without expense to art should have to do with fostering health, convenience and happiness on the part of the inhabitants, economy, dignity and system on the part of improvements, and conservation in the broadest sense in regard to industries.

Municipalities must face the fact that they have to provide in advance, facilities for well-ordered play and recreation on the part of both old and young, as they would provide for streets and sewers, for police and fire departments. If such provision is made in a comprehensive and systematic manner, it is obvious that great and unnecessary expense will be saved, that parks will be located more correctly as to topography and accessibility, will serve all parts of the city and will aid the city in the broadest and most logical way.'

Such provision in advance would at once obviate the danger of criticism in regard to undue interest on the part of real estate owners whenever the time for action for securing park land should arrive.

Parks Enhance Value of Property

The enhancement in the value of real estate due to the establishment of parks, parkways or similar improvements made nearby, has many interesting illustrations. Observation will show that the realization of this fact has led numberless real estate owners eagerly to take up land contiguous to or adjacent to proposed improvements of this sort. Many out-of-the-way places previously occupying but an obscure place in the real estate market, have jumped to well nigh fabulous prices at the advent of a park in the neighborhood.

In innumerable instances, it is found that land skillfully treated by landscape architects has been made to sell at prices far beyond that boasting only of the ordinary and stereotyped class of improvements. While it is only natural to look for the finest residences on old established parkways, it is interesting to note the rapidity of high-class development brought about in hitherto cheaper sections of the city by the installation of well-developed landscape improvements.

Minneapolis Values Rise a Thousand Per Cent

Some five years ago the park commissioners of Minneapolis began undertaking the reclaiming of land around the shores of the Lake of Isles, deepening the lake and causing the surrounding land to become high and well drained. At that time, building lots occupying the rise of ground overlooking the lake were selling at from $400 to $1,000 each. These same lots are selling today at from $4,000 to $6,000 each. During these five years there has been a marked increase in real estate values over the entire city, but nothing to compare with this instance, plainly showing that these improvements are responsible for the advance.

An instance in Ft. Wayne is an interesting illustration. A certain lot located opposite a then unimproved park was in 1911 sold for $750. Three months thereafter it was resold at an advance of $100. During 1912 the park was improved and in May of this year, this lot was again sold for $1,250, the former owner assuming assessments against the lot amounting to $30, which took care of his proportion of a $15,000 fund, raised by special assessment for the development of the park.

A statement issued by the park department of Seattle, Wash., shows that real estate values on property abutting upon or adjacent to park improvements have

increased from 25 to 40 per cent above land not similarly situated.

St. Paul Four Hundred Per Cent Increase

From St. Paul comes the word that real estate values adjacent to parks have increased five times in value since the parks were established and partially improved. The lots on Lexington parkway have increased 300 per cent, the lots on River boulevard more than 500 per cent and on Wheelock parkway, not completed, the increase has been 100 per cent.

The annual report of the Kansas City park board for 1910, bears the statement that on Benton boulevard, upon which the abutting property has responded in a less degree in increments of value than on any other boulevard in the city, it is shown conclusively that the increase in value has been more than 183 per cent since the establishment of the boulevard and that after deducting the cost to the property owner of every class of improvements with which this frontage has been assessed, and deducting also the average increase of land values thruout the entire district, which includes increments due to this and other park improvements in the same district, there has been a clear net profit, demonstrably due to the boulevard, of approximately 44 per cent. Upon other boulevards, notably Armour, Gladstone, Linwood, Gilham Road and the Paseo, the gain has been from 200 to 500 per cent, the greater portion of it being directly attributable to the establishment of the boulevards.

Chicago Reports Nine Hundred Per Cent Increase

A case in point in Chicago is especially interesting. A section of the North Shore, constituting some twenty acres was in 1902 held at $200,000 and was in line for purchase for development as a public park. Later on, however, it was decided to build a park by reclaiming the submerged shallows of the lake along the frontage of the property. In 1906, after these improvements were nearly completed, this same twenty acres was held at a price amounting to $2,000,000, which constituted more than the cost of the improvements.

Profits on Excess Condemnation Revert to People

To such extent, in fact, have increases in real estate valuation been due to park improvement, that excess condemnation laws have been repeatedly enacted in Europe and to some extent in the United States.

Oklahoma City, operating under such a law took occasion to issue bonds for $400,000 for the purchase of land for park purposes. A tract of 1,500 acres was acquired, a portion of this deemed sufficient for park purposes was set aside and the remainder was cut up into building lots and sold. Out of an investment of $15,000, in two years the sum of $36,000 was realized.

Without going into details of various statutes relative to excess condemnation, it may be seen that thereby a community is safeguarded against the operation of land sharks and that returns due to tax investments are caused to revert directly to the property holder. By such methods, park improvements, if wisely undertaken, may be made without cost to the city.

In Germany, where it has long been customary for municipalities to own and control land, many cities, notably Berlin, Vienna and Frankfort, own from one-third to one-half of their entire municipal area.

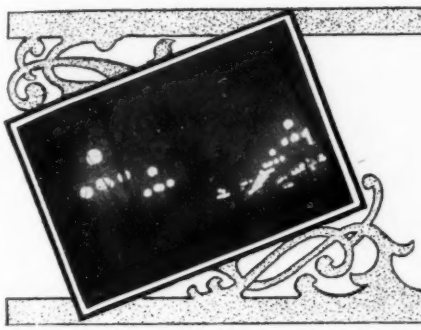
The exorbitant prices charged for business frontage along the principal avenues and boulevards of Paris, Berlin and London, demonstrate full well the advantages due to these features.

It has been stated that when a park fronts on a street devoted to retail business, the effect upon the business side of the street is depreciating, owing to the lessened number of poeple drawn to the district. In the instance of Michigan avenue, Chicago, that part which fronts on Grant park is fast becoming one of the most popular and attractive real estate sections of the city.

Philadelphia City Tax Funds Profit at Once

In Philadelphia, where a magnificent parkway some 250 feet wide is being opened between the city hall and Fairmount park, a distance of one and one-quarter miles, it has been estimated that property on streets intersecting with the main parkway and extending for a distance of 300 feet in either direction, together with property facing directly on the proposed improvement, will be enhanced in value from $10 to $50 per foot, forming an aggregate increment which when capitalized at 5 per cent would make over $14,000,000 in new values. Upon this value at the present tax rate of $1.50, $210,000 would be produced, which is interest upon a trifle less than $8,000,000 of city loan at 3 per cent. This sum being in excess of charges assessed, a revenue will accrue to the city immediately.

A most striking example of success due to excess condemnation related to business streets of the boulevard type, is Northumberland avenue, London, where the amount realized by the disposal of surplus land exceeded the cost of the improvements by 119,000 pounds, about $550,000.



FIRE AND WATER

Chlorine or Hypochlorites for Sterilizing Water

In a brief articles prepared for the English *Surveyor and Municipal Engineer*, Eric K. Rideal states his reasons as a chemist for prefering hypochlorite of lime or magnesium to chlorine for sterlizing water:

At the present time, when many waters are being treated with electrolytic bleach, with bleaching powder, or with magnesium hypochlorites, in order to produce a sterile water supply, it is important to investigate whether the purifying agency of the added substance is chlorine or not. For if it is chlorine that is the potent germicide in the water we have at first to investigate the action of dilute chlorine water on the human system, for which the water is intended, and, secondly, to discuss whether chlorine gas *per se* would not be a more economical form of treatment.

Pettenkofer and Lehmann say that 1 to 5 parts of "free" chlorine per 100,000 parts of air affect the respiratory organs, while 6 parts per 10,000 soon prove fatal. Koch also spoke firmly against the use of free chlorine, showing that it was poisonous in a similar manner to bromine and iodine, two other well-known halogens.

Various authors from time to time have shown that chlorine itself in the gaseous state forms only a fair disinfecting or sterlizing medium, while solutions of bleach are comparatively strong, strengths such as 1 to 5 parts of "available" chlorine per 1,000,000 usually sufficing to sterilise contaminated waters. The differences noticed between these two "chlorine" disinfectants are accounted for by their different mode of working. The action of chlorine on water containing traces of organic matter and also organisms is threefold.

A part of the chlorine attacks the organic matter and liberates substituted chloramines; these, as my father has shown, are very strong germicides, and are consequently of great utility in the water. Some of the chlorine acts directly on the organisms as a toxic agent, while the greater part of the chlorine (in the case of a water that does not contain large quantities of organic matter) is only slowly decomposed by the water into hydrochloric and hypochlorous acids. This occurs more rapidly under the influence of light.

Since hydrochloric acid is a strong acid, it will replace the carbonic acid in the carbonates that are probably already present in the water, setting free carbonic acid at the same time. If, on the other hand, the quantity of carbonates in the water is low, such as is the case in very soft waters, the hydrochloric acid formed by the chlorine will give the water a marked acidity, which, in the course of time, will affect the water conduits and pipes. The hypochlorous acid remains free and liberates oxygen when in contact with organic matter.

This hypochlorous acid is a strong disinfectant and steriliser, it possesses the advantage shared only by ozone and the peroxides (including nascent hydrogen peroxide liberated from the "per" salts) —namely, that it only liberates oxygen in the nascent state.

In the case of hyopchlorites, such as bleaching powder or electrolytic hypochlorites of sodium or magnesium, the only salts in solution are, firstly, neutral chlorides, that at such dilutions possess no physiological action whatever. The effect of adding calcium or magnesium hypochlorites to a hard water will be merely to increase slightly the hardness of that water. This may be obviated by using electrolytic sodium hypochlorite, which will not increase the hardness, but, in certain cases, will, in fact, soften it.

Secondly, calcium or sodium hypochlorite; these, if treated with strong acids, will liberate chlorine, which, as has already been shown, possesses marked toxic properties. If, however, they are treated with dilute weak acids (such as carbonic or humic), they liberate hypochlorous acid. This substance will sterilise the water by means of its oxygen liberating capacity. Thus, sterilising

by hypochlorites in normal waters, which contain free carbonic acid, is equivalent to sterilising by means of oxygen; the mere traces of chlorine that may be evolved are at once fixed by the substituted ammonias of the organic matter to form chloramines. There is at no time in the water a large quantity of free chlorine, as is the case in waters which have been treated with chlorine water.

Again, it is to be remembered, when the suggestion of treating water supplies with chlorine or hypochlorites is made, that one has to face the possibility of an overdose occurring thru some accident or neglect. In the case of the chlorine treatment, the effect might prove disastrous, while with hypochlorites a slight increase in the salinity of the water would be the only result.

Another point in favor of the hypochlorite treatment, whether the hypochlorites of sodium, magnesium or calcium be used, is that the crude chemicals do not exert that powerful destructive effect both on the human system and on the vessels with which they come in contact, which is the characteristic of the halogens. Very special precautions, indeed, would be required if liquid chlorine in bombs were to be used as a disinfectant for water or effluents.

Although the price of chlorine falls considerably below the market value of any form of hypochlorites, from these considerations it may be perceived that the employment of free chlorine for water supplies has its grave disadvantages, which are not shared by the hypochlorite treatment.

A Municipal Watch Tower

Thirty years ago the city of Indianapolis established in its court house tower watchmen whose sole duty it was to scan the city night and day for fires which had not yet been discovered by the occupants of the property affected.

On the fourth night after his first "trick," Frank W. Graham, who has been in charge of the tower since this auxiliary method of detecting fires originated, turned in an alarm on a blaze that was not known to have started until the fire department arrived. A continual demonstration of efficiency caused the city to install very soon a twenty-four-hour watch, which has continued for practically thirty years.

The growth of the city and the erection of numerous tall buildings has made it imperative to locate this branch of the service at a higher point. It now occupies a tower 280 feet above the street, from which it is possible to view the entire city and surrounding country for a radius of twenty miles with an unobstructed view. With the aid of powerful binoculars the character of a fire can be quickly discerned, whether it be the burning of a rubbish heap or a small blaze under the eaves of a roof. This method of observation has saved property owners many thousands of dollars and in a number of instances has been the means of preventing serious conflagrations in congested and highly inflammable districts.

The watchmen work in three shifts and are in constant communication with the fire-alarm telegraph system by means of directly connected telephone service.

The thorough familiarity of the watchers with the city, the use of carefully drawn maps and instant means of communication all tend to facilitate very greatly the work of the department, as well as to increase materially the efficient safeguarding of property.

The police department has installed a powerful searchlight, which can be directed in any direction, for the purpose of testing it as a means for signalling to policemen on their beats and directing a light upon any point desired. The chief of police is quite sanguine of its success and if his expectations are realized it may not be necessary to extend a police signallight system thruout the city. The expense of such a system has thus far prevented its adoption, altho it is much needed, and the possibilities of the searchlight will be thoroly tested.

Temporary Track Construction Causes Water Main Electrolysis

An unusual damage suit was brought against the Pacific Electric Railway company in the city of Los Angeles recently by the public service commission, charging the company with damage to the city's water mains to the extent of $42,500, by allowing electrical current to disintegrate the pipes.

The railway company admitted its liability, the case was settled by arbitration and the amount paid in full.

The damage was caused when the railway company put in a temporary system along Sunset boulevard, while the old narrow-gage tracks were being replaced by standard gage. The temporary rails were not bonded together and the electrical currents escaped into the ground.

When the water was turned on in the city's 42-inch water main, which paralleled this track, it was found that the electric current had deteriorated the pipes, making them useless. Engineers made a special investigation and it was found that the damage was caused by electrolysis and the pipes had to be replaced at the expense of the Pacific Electric company.

ORGANIZATIONS AND INDIVIDUALS

New Municipal Newspaper

"Telling the stockholders of that corporation known as the city of Los Angeles how their affairs are being managed," thus does Robert E. Rhinehart, managing editor of that unique publication the "Municipal News," characterize the object of a distinctly municipal newspaper.

Eliminate telegraphic news, scandal, accidents, society, sports, the comic supplement and many other features that are so prominent in the privately owned newspapers, and you have just a glimmering idea of the "Municipal News." The people of Los Angeles pay $36,000 a year for it in order that they may be intelligently informed on how their taxes are being spent.

Last year the people voted that they should be kept constantly informed, from an unbiased viewpoint, of the administration of their taxes, and of how their city solons were proposing to govern them by ordinances. Today 60,000 people have delivered at their doors each week important facts about the city hall.

It is Mr. Rhinehart's duty to put the "spotlight" on the various city departments, informing the people of what is being spent and what planned, and of ordinances that are pending, with discussions of both the advantages and disadvantages of such proposed city laws. In a community which has the power of the initiative, referendum and recall these discussions are particularly valuable, as many questions come to a popular vote and must be carefully studied by the voting public. Both sides of questions are presented in parallel columns in order that each may be properly considered. The same method is pursued in giving space to political parties, of which there are five. One column is allotted to each in every issue, the matter being prepared by the party committee.

Every effort is being made to make the paper self-sustaining. Mr. Rhinehart's wide experience in the newspaper field has enabled him to lay down a broad and comprehensive business as well as editorial policy. The merchants of Los Angeles are giving their strong support in form of advertising. The standard set is of the very highest. Any advertising of the least immoral or fraudulent tendency is barred. Its pages are closed to patent medicine, clairvoyants, loan sharks, quack doctors, saloons and the like. The receipts from advertising are used to increase the circulation, number of pages, illustrations and feature articles.

Robert E. Rinehart, Editor of Los Angeles Municipal Newspaper.

Mr. Rhinehart is a young man, only 34 years old, but a veteran in the newspaper, magazine and publicity professions. He is a graduate of Princeton (1904), and was for some time on the editorial staff of the New York Sun, with the Scripps papers in California, and editor of a magazine published by Bobbs-Merrill Company of Indianapolis.

Technical Associations

The ninth convention of the American Wood Preservers' Association was held in Chicago, January 21, 22, 23. The subjects discussed included preservatives, plant operation, various forms of timber and paving blocks, a session being devoted to each class of subjects. A number

of excellent papers were presented by the experts which compose this progressive society. F. J. Angier, Mt. Royal, Baltimore, Md., is secretary.

At the annual meeting of the municipal engineers of the city of New York, James W. Nelson, president of the Brooklyn Engineers' Club, gave an illustrated lecture on the Panama Canal. George A. Taber, secretary, 29 West Thirty-ninth street.

The fourth annual meeting of the American Society of Engineering Contractors was held on January 14, in New York city. The principal papers presented were one on "Legal Hints to Contractors," by William L. Bowman, civil engineer and attorney at law, and one on "Fire, Its Effects and Prevention," by Edward F. Croker, former chief of the New York fire department, now president of the Croker National Fire Prevention Engineering Company.

The sixth annual Chicago cement show, held Jauary 16 to 23, was as successful as its predecessors. Motion pictures of the Wayne county roads, out of Detroit, Mich., were a novelty. So was the "paving determinator" for making practical wearing tests of paved surfaces.

The annual meeting of the New England Water Works Association was held in Boston, January 8. The morning session and part of the afternoon session were devoted to reports of committees. Papers were presented by Charles W. Sherman on "Experience wth Water Rams," and by Robert J. Thomas, superintendent, on "The Water Works of Lowell and Some Recent Improvements." Willard Kent, secretary, Narragansett Pier, R. I.

The National Civic Federation held its annual meeting in New York, January 28 to 29. The principal questions discussed were more mediation in industrial disputes, regulation of public utilities, workmen's compensation, pensions for employes, reform in legal procedure. Ralph M. Easley, Metropolitan Tower, New York city, is chairman of the executive council.

Civil Service Examinations

The United States Civil Service Commission will hold examinations at the usual places as follows:

February 24—Petroleum engineer to investigate oil and gas wells and transportation facilities, at $2,000 to $3,600 a year.

February 26, 27—Assistant irrigation engineer, office of experiment stations, Department of Agriculture, for service in the field, at $1,200 to $1,600 a year.

March 12—Aids and computers in United States Coast and Geodetic Survey; assistant engineer and junior engineer, reclamation service; computers, architectural draftsmen, engineers, heating and ventilating engineers, junior architectural draftsmen in supervising architect's office; topographic draftsmen and coypist topographic draftsmen in departmental service; junior engineer in engineer department at large; forest assistant in forest service; forest assistant in Philippine service; superintendent of construction.

April 9—Aid, cadet engineer, cadet officer in lighthouse service; computer in nautical almanac office and naval observatory; mechanical and topographic draftsmen in Isthmian Canal service; engineer, Indian service; junior civil engineer, junior mechanical or electrical engineer, in engineer department at large; junior mining engineer, in bureau of mines; surveyor in Philippine service; assistant examiner in patent office; assistant observer, civil engineer and draftsman, civil engineer and superintendent of construction, civil engineer student.

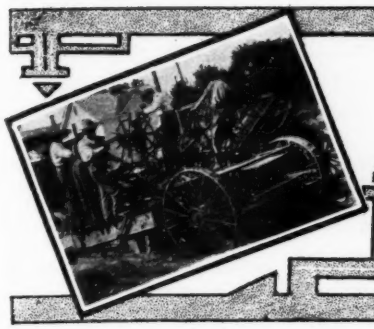
Personal Notes

J. E. Pennybacker, secretary of the American Highway Association, has been selected as statistician to the joint congressional committee on Federal aid in the construction of post roads. He retains his position in the association, the work being in the same line. His work on the association's year book is largely responsible for his selection by the committee. An exhaustive study of foreign and American road systems will be made under the energetic supervision of Hon. Jonathan Bourne, Jr., the efficient chairman of the committee.

George F. Swain, professor of civil engineering at Harvard University and for many years head of the civil engineering department at the Massachusetts Institute of Technology, was elected president of the American Society of Civil Engineers on January 15.

Godfrey Sperling, who has been engaged in civil engineering practice for seven years in the Overland building, has removed his offices to the Shaw building, Boise, Idaho.

W. P. Fowler, for several years city engineer and county surveyor at Wabash, Ind., has gone to Meridian, Miss., where he will act as city engineer.



MACHINERY AND SUPPLIES

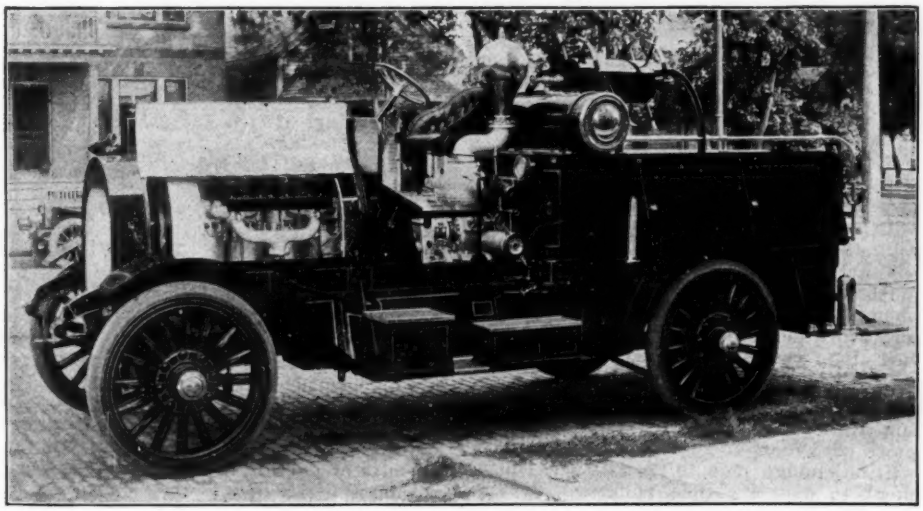
A Modern Pumping Engine

By C. F. Croner, Captain, Fire Department, Eugene, Ore.

The city of Eugene has taken successfully its first step in motorizing its fire fighting apparatus. The Nott combination pumping engine added to the Eugene fire department, August 12, has proved a good investment for the city in the reduction of 5 per cent in insurance rates, and more especially in the service it has rendered in the fires there have been in the months since its purchase. This machine pumps 760 gallons of water per minute, has a 40-foot extension ladder, carries 1,500 feet of hose, also a 60-gallon chemical tank and runs at a speed of 40 miles per hour.

Our mayor, F. J. Berger, witnessed the test of this engine at Portland, Ore., on July 25, 1912, and his observations resulted in its purchase.

All of the gage readings were made by Capt. Dolson and Master Mechanic Phillips, of the Portland fire department, using their standard fire department nozzles and their own pressure gages. The engine delivered thru two 250-foot lines of 2½-inch hose, with 1⅛-inch nozzles 626 gallons, holding 70 pounds on each nozzle; drawing water from a cistern eight feet. The engine was taken to Salem, Albany, Corvallis and Independence and then to Eugene and demonstrations were made in all these places. On the official test at Eugene with two 200-foot lines drawing water eight and nine feet, with 1⅛-inch nozzles, it delivered 650 gallons, holding strong 75 and 80 pounds on the nozzle and from 130 to 135 pounds on the pump. After driving this machine 96 miles over rough country roads and demonstrating it in various cities, every part of the machine was found to be in perfect working order.



Nott Pumping Engine.

We are proud of our auto combination motor pumping engine. It is a very efficient fire fighter and its mechanical features appealed to us from the start.

The chemical tank is very neatly placed under the rear axles and under the hose box, being out of the way, and it runs on a steel track with rollers. With one finger it can be pulled up for operation and reloading and after service shoved back and automatically locked in position. The hose wagon carries from fourteen to fifteen hundred feet of hose, with the rest of the paraphernalia commonly used for fire department hose wagon, and has ample room for ten to twelve men.

The machine has been called to fires at a considerable distance from the central station and has made most excellent time. Paved streets reaching every section of the city make it possible to travel at the maximum speed even in the rainiest weather. Especially was the machine useful on January 8, 1913, in gathering up from several hose houses the hose needed in a stubborn basement fire in a downtown block.

The machine is equipped with a four-cylinder engine, 5¾-inch bore by 8-inch stroke, and develops 100 horsepower by brake test, while the A. L. A. M. rating shows 53 horespower. The crank shaft is 3 inches in diameter with cone clutch 21 inches in diameter. The clutch weighs 400 pounds and acts as a flywheel. The engine is water cooled. The wheels are 42 inches in diameter with 6-inch rubber tires.

The comparative cost of the old system and the new cannot be given accurately, both because of the shortness of the time which the automobile has been in use, and also because of the changes in the manner of handling the department. With the horse-drawn hose wagon and chemical, two men were employed at $75 and $60 a month, and volunteers were relied upon to do the greater part of the work.

The city council at its January meeting authorized the employment of three more paid men, so that at all times there will be enough men to go with the equipment to man it. The volunteer department has been disbanded.

Fire alarms are given through the city telephone system, and as there are 1,670 phones in the city, covering practically every block, it gives a very accurate system for the calling of the department. "Eugene fire department 1000" appears across the very top of the cover of the telephone directory, and we insist on knowing the exact location of a fire before starting and are thus enabled to go by the nearest streets direct to the fire, passing a hydrant on the way.

Practical Playground Apparatus

By Harold O. Berg, Supervisor of Recreation, Milwaukee Public Schools, Milwaukee, Wis.

Our gymnasium outfits consist of inclined ladders and sliding poles, sliding chutes, vertical poles and ladders, flying rings, trapeze, teeter ladders and traveling rings.

Giant strides, swings, see-saws and slides are very popular in out-door playgrounds. Lawn swings seem to be the most popular with the little tots, while the giant strides strike the fancy of the older boys. Teeter ladders are popular with girls, but not with the boys. Taken in all, however, traveling rings are as popular as anything on the playground.

Our playgrounds are situated in the most congested sections of the city so as to afford playing and breathing space for the poorer classes of children, who, otherwise would have no place, aside from the street and alley, in which to play.

Altho parents are deeply appreciative of playground opportunities, they are exceedingly vindictive in case their children are injured while at play and for this reason we purchase steel playground and gymnasium apparatus. Our apparatus is very largely made up from standard galvanized pipe. The few wooden parts, such as see-saw boards, box swings, etc., have three coats of lead and oil paint, as this finish is considerably better for out doors than an oil and shellac finish. All the metal parts are galvanized. All the pipes which go into the ground rest on concrete foundations.

Our teeter ladders are 12 feet high. Each side is made of a piece of 2-inch galvanized pipe and the rungs are made of ¾-inch galvanized pipe. The rungs are let into the pipes which form the sides and are riveted thru. Nicely shaped iron hand-holds are fastened into the ends of the pipes which form the sides. The central pivoting casting is made suitable for a 3-inch perpendicular pipe support. The ladder is readily adjustable to any height. This is an important feature and in our opinion necessary for practical use. It permits of putting the ladder within easy reach, thus reducing the possibility of accidents.

Much time and money was spent experimenting with various forms of swings in an effort to produce something which would stand the severe use it is subjected to in the average playground. Rope supports required replacing from one to three times each year and the ropes stretched unevenly, making resplicing constantly necessary. Chain supports were an improvement over the ropes, but they did not permit of a firm grasp and cramped and pinched the children's hands. Our

swing is tru y all steel, as even the seat is made of steel. The seat is pressed to correct shape and edges are rolled and turned underneath. The supports are made of ½-inch diameter drop-forged steel links. These links are drawn to make the diameter smaller at the ends than in the center, forming a shape particularly suited for the grasp of a child.

The playground apparatus used in the gymnasium and playgrounds of Milwaukee public schools is made by the Fred Medart Manufacturing Company of St. Louis, Mo.

A Gasoline Pump for Park Use

The accompanying illustration shows a unique application of a small pumping engine, manufactured by Fuller and Johnson Manufacturing Company, Madison, Wis. The engine, attached to an ordinary portable force pump, is used for sprinkling parks, lawns and for pumping water to various parts of public parks, where water from the city supply may not be available. Several cities thruout the country have purchased these pumping engines for use in public parks and have found them so generally satisfactory that the practice will undoubtedly extend to other cities thruout the country.

Fuller & Johnson's pumping outfit in use in park system.

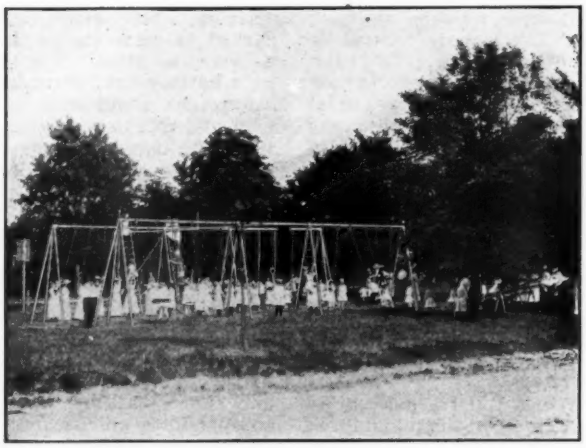
The engine was designed originally for general farm purposes and its general utility for such work makes it particularly adaptable to the purpose above mentioned. The engine is a vertical, single-cylinder, four-cycle gasoline motor, having a cylinder 3½x3½ inches with a speed of 500 to 600 revolutions per minute. It is air-cooled and has a gravity oiling system which enables it to stand extremes of temperature under high duty without reduction of efficiency. The carbureter is supplied with an automatic damper valve for shutting off the air when starting. This insures the rich mixture needed to start the engine at once, even in zero weather. The engine complete with battery box, ignition coil and batteries weighs about 280 pounds. It is sold f. o. b., Madison, Wis., at a price of $70. The manufacturers will supply upon request a complete catalogue showing the various use to which this unique gasoline motor is adapted.

"Everwear" Playground Apparatus

The quality of apparatus selected for playgrounds is a potential factor in their success or failure. As the development of playground work becomes more effective and thoro, the use and strain to which equipment is put becomes more and more severe. Playground equipment must, in fact, not only withstand hard use, it must withstand abuse and must give good service under the worst conditions of heat and dust. It must also be durable, simple and safe.

The Everwear Manufacturing Company, Springfield, Ohio, has placed on the market a series of all-steel, galvanized play outfits which covers all kinds and styles of apparatus necessary or desirable for public playground use. The outfits are sold under a guarantee covering materials, workmanship, durability and maintenance costs.

The fittings of special heavy galvanized wrought iron are made tubular to admit of use on standard sizes of galvanized wrought pipe and are equipped with compression shoulder bolts or set screws instead of threads. The shoulder bolt is recommended and used for fastening all top runs, thereby providing perfect rigidity and safety. All swings and swing outfits are equipped with forged steel link suspensions with a roller bearing clamp attachment providing the greatest pos-



Everwear Playground Equipment.

sible freedom of action. The "giant strides" and similar devices are equipped with ball bearing heads.

An attractive illustrated catalogue H-2 gives complete descriptions and prices of the entire line of equipment and the various combination outfits offered. The combinations are designed to meet the fullest requirements for any size playground desired.

New Use for Diaphragm Pumping Engine

During the last year the owners of tanneries have tested out the value of the Atlantic diaphragm pumping engine for pumping out tannery vats and other purposes in their business. Formerly they have resorted to the usual hand pump, requiring anywhere from 3 to 8 men to handle it, which has made the labor cost high. Last year they began to experiment with the Atlantic pumping engine and have been greatly surprised and pleased to find that expense could be reduced most decidedly.

The Atlantic diaphragm pumping engine is built on such correct constructive principles that it requires no attention, except the filling occasionally of the oil cups, for 24 hours a day. The Atlantic engine can be attached to various kinds of pumps to suit special kind of work, in fact, it can be attached to the hand pumps contractors may now own.

Each engine is thoroly tested before shipment and a record is kept of its brake h. p. delivery. The whole outfit is attached to a channel iron frame, mounted on low cast iron wheels with swivel front axle and drawing handle and can be wheeled around on the ground by one man. The batteries, coil and starting switch are in a battery box. The electrical equipment consists of six best quality dry batteries and a first-class jump spark coil in connection with a reliable mica spark plug. The gasoline tank has a capacity of one gallon, which is sufficient for operating the pump for 8 hours.

The mechanical points of the engine may interest our readers. The engine is 3½-inch bore, 3½-inch stroke, normal speed 500 revolutions per minute, but the speed may be changed while the engine is running to vary from 300 to 700 r. p. m. without injury to any of its parts. This gives a speed to the pump of from 30 to 40 strokes, as may be desired. The engine has a capacity of 3,500 gallons per hour. Fly wheel is 14 inches in diameter. Jump spark ignition, special generator valve and everything necessary to make a perfect engine. All gears have cut teeth. Pinion of steel and the cylinder is cast in form of a sleeve, properly bored inside and machined outside, thus providing cylinder walls of uniform thickness. The water jacket and cylinder construction make the engine absolutely frost proof and no serious damage can follow, even tho water should freeze in the water jacket.

The engine is provided with a special and original speed regulating device which operates on the governor by increasing the tension of the spring on the governor weight and at the same time advancing the timing of the spark. The gears and levers are mounted between two plates, so that there is no overhang or side pull, which is the case when these parts are mounted on studs screwed into side of engine frame. The adjustment of the engine is such that the pull on the brake beam of the pump is in exact pro-

portion to the increase or decrease of speed, and the engine consumes current from the batteries in exact step with the horsepower delivered. The connecting rod is of steel and carefully babbitted. Every part of the engine is made to template, insuring interchangeability of parts.

Resurfacing of Streets

By R. M. Davis, President, Metropolitan Paving Company, St. Joseph, Mo.

During the past three years we have re-surfaced 35,000 square yards of pavement for the city of St. Joseph and have now 25,000 square yards of re-surfacing under contract. This re-surfacing of old brick, stone and asphalt pavements has been uniformly successful from the standpoint of economy as well as durability.

Old pavements can be re-surfaced with a 2-inch asphalt top at an average cost of $1.50 per square yard, and after this re-surfacing is done you have, in my estimation, a much stronger pavement than the original. A properly re-surfaced pavement is stronger than a new pavement because you have really a double base.

In re-surfacing we fill ordinary depressions with asphalt binder and cushion, but we re-lay in case of a big depression.

The machine which we use in this work is the Lutz surface heater, made by the Equitable Asphalt Maintenance Company of Kansas City, Mo.

The Lutz method consists in drawing a large volume of air, heated to a proper temperature, from a heating chamber and blowing it with great force upon the asphalt or other bituminous pavement, thereby gently heating and softening, without flame, the old pavement to the same consistency as the new material. Then, with the use of hoe and rake, all disintegrated materials, uneven or worn surfaces are removed and joints cut, while the pavement is still hot, sufficient new material to bring up the grade and contour of the street is added. The temperature of both materials being at vulcanizing point, when tamped, smoothed and rolled, a perfect weld is produced, leaving a finished surface. Instead of having a "patch," the repair becomes a part of the whole.

In re-surfacing brick or stone pavements, the old pavement is first thoroly cleaned and is then heated gently with a continuous blast of heated air from the Lutz machine. No flame is permitted to come in contact with the pavement to overheat or burst any part thereof. Under this heat the pores of the brick or stone are opened, and while in this heated state it is painted with a hot liquid asphalt. After the pavement has been cooled, the pores being closed, the new asphalt mixture is applied, which makes a perfect adhesion.

Lutz Surface Heater in Use.

The Making of Street Signs

By F. M. Burdick, of the Burdick Enamel Sign Company, Chicago, Ill.

The question has been raised as to the reasons why the great majority of municipalities in ordering enamel street signs specify white letters on a blue background.

This point, as well as several other important features established in the manufacturing of enameled signs, is thoroly covered in the following communication from Mr. F. M. Burdick, president and treasurer, of the Burdick Enamel Sign Company, Chicago.

"The white letter on a blue background is conspicuous," writes Mr. Burdick, "and this color combination is harmonious and very readily read either in daylight or by electric or gas light. These colors do not show dust or dirt as readily as others.

"We use English charcoal rolled iron, No. 18, United States standard sheet-metal gage, in the manufacture of our signs because it is practically free from imperfections such as blisters, scale and other foreign substance, which are detrimental to enameling. The advantages of iron over steel are due to the fact that the iron is fibrous, open and porous, which when heated, allows the enamel to become thoroly impregnated with the metal base, which in turn, makes a more durable sign, on account of the porous nature of the iron. Bessemer, or open-hearth steel, is not porous, consequently the enamel can not deeply imbed itself in the body of the metal, as is the case with the iron sheets. The enamel merely clings to the surface of a steel base and will readily scale off, and when the enamel does scale, the steel base is exposed to the elements and readily corrodes, which in turn, undermines the balance of the enamel plate and causes the enamel to readily fall off and disappear.

"The reason why we use five coats of enamel in the making of our street signs is because our enamels are very hard,

which in turn makes them more durable and better able to resist the elements. The fluxes are reduced to a minimum. With our hard enamels it is necessary to apply them thinly and apply one coat after another until we get the desired finish. That is why five coats of enamel are required to make our signs.

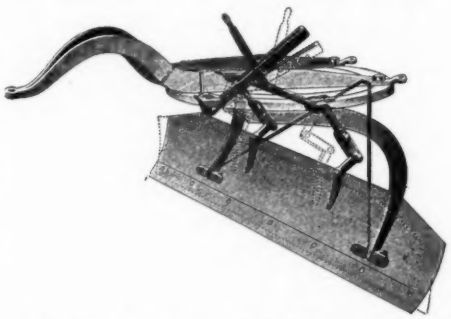
"Our vitreous porcelain enamel, we claim, is better than other enamels for the reason that it is harder enamel. The acids of the air that the signs are naturally exposed to when put out doors will in time affect the soft enamel. We use the hardest kind of enamel that we can obtain. This enamel costs considerably more than the cheap enamel, but is better in every respect. Softer enamels can be applied heavier and thus reduce the number of coats, which are necessary to apply to produce a finished sign, which in turn reduces the amount of labor required and the amount of fuel consumed in the enameling, but with the reduction of the fluxes, their wearing qualities are also greatly reduced, which causes the finished sign to rapidly deteriorate and fade when subject to atmospheric conditions.

"We fuse our enamel at 1800 deg. F., because it cannot be fused at a less heat, as the enamels are so hard and the flux is reduced to such a low point that they cannot be properly fused at a less heat than 1800 degrees F., while the enamels on the cheaper signs contain so much flux that they will readily fuse at 1000 to 1200 degrees F."

Labor Saving Machinery

"Roads are not temporary," states one of the leading contractors of Omaha, Neb. "When one is built it is intended to be used until worn out and it is manifestly to the township's, county's or municipality's interest to build the kind which gives the best results at the least annual cost, and do not overlook the fact that first cost plays an important role on arriving at the annual cost. The first cost is most seriously considered by the letter of the contract as well as the bidding contractors. The contractor, in self protection, must figure on the use of labor-saving machinery of the most advanced types because the more manual labor he can save the better his chance of landing the contract. Man and horse-labor is a scarce and expensive article during many months of the road-building season, and it pays the contractors to eliminate both as far as possible. Those contractors who make the most extensive use of labor-saving equipment, and thereby reduce their costs, are the contractors who not only land the most contracts, but who turn out the best work.

"Each road has its own peculiarly difficult problems and the machines most economically efficient are those machines which most readily adapt themselves to the greatest number of these problems which bob up on every piece of road-building construction. To illustrate, permit me to state that we find that the Western Reversible or Blade Grader readily adapts itself for either leveling or finishing off embankments or for making ditches in cuts. This machine cuts into banks at an exceedingly short angle and can be operated by one man, besides the driver. It does the work of some machines requiring many men and thus effects a considerable saving. The Western Special Reversible Road Machine is a type which is built extra heavy and is equally suited for stumpy or rooty or strong ground. This machine, while of draft heavy enough to withstand the roughest propositions encountered in difficult road work is not so heavy but that



Tilting arrangement showing blade, gooseneck and circles of, the "Western Reversible Road Machine and Ditcher."

it can be used on ordinary work and really takes the place of two machines.

"Time is one of the most important elements entering into road-building contracts. I cite this fact inasmuch as a contractor is oftentimes obliged to crowd the work night and day. He does not always have time to wait for new machinery and it is a relief to have in operation a type of machine to which he can add two to four extra horses or a tractor and push it thru as fast as power can tear it. It pays to have a machine on the job which will stand such a strain without injury or breakage. The 'Western' has the advantages which will appeal to contractors, such as an absolutely direct drive as well as a special tilting arrangement for placing the blade at a position on the riding platform. The floating scraper blade does not dive or turn in and is always under the operator's control; it cuts smoothly and does not hold on an obstruction until its stops the source of power or breaks.

"No matter the position of the wheels,

the scraper blade remains in the same position and thus cuts evenly. This blade reverses and consequently the machine is easily reversed in standing position. It has a circle within a circle, thus making this reversing process simple and easy from a mechanical standpoint.

"The building of durable and well constructed highways is engaging the serious attention of state, municipal, county and township officials in all sections of the country. More large bond issues for such improvements will be floated in 1913 than in 1911 and 1912 combined and it behooves all contractors to so systematize their organizations that they will be in a position to handle large work at the right price. The right sort of labor-saving machinery gets contracts for the simple reason that it makes successful bidding possible."

The two machines described above are made by the Western Wheeled Scraper Company of Aurora, Ill.

Cutting Mixing Costs

By Bresse & Brown, Contractors, Mattoon, Ill.

The automobile is bringing a demand for more smooth pavements.

It is surprising to note the number of taxpayers in our smaller towns who own automobiles, and, as a consequence, more pavements will be laid in the spring of 1913 than ever before.

Small towns and cities vie with one another in raising their mileage of paved streets. This demand for the maximum mileage of paving means that the contractor must make use of the latest perfected labor-saving machinery in order that his labor yield him a profit.

In our paving work at Shelbyville, Ill., as well as in all of similar work in 1912, we used a low charging mixer with cart charger, because by using a number of these cars, which are pulled from material piles onto the platform to dump, by means of a single cable hoist, we were enabled to cut out the expense of several men as well as to secure more rapid work.

This cart-charging mixer, which does away with the use of wheelbarrows for bringing the material from the piles to the drum, is made by the Standard Scale and Supply Company. Each of the several carts which we use have a full one-batch capacity.

The complete batch, including the gravel or stone, sand and cement, are placed in the carts on the ground level and the whole batch is pulled from the material piles onto the mixer platforms by the power that operates the mixer, and is ready to be charged into mixer as soon as the previous batch its discharged from the drum. With the carts there is no clogging and no necessity for pounding on the bottom, or using other methods to make the discharge clear.

The cart is then taken back by the man who guides it to the mixer and the rope is removed from the empty cart and attached to another loaded cart and the process is repeated.

The man operating the engine on gasoline outfits also operates the hoists and the automatic water tank, and it is not necessary to have a man on the mixer

The "Standard" Mixer on street paving work, Shelbyville, Ill. Bresse & Brown, contractors.

platform, consequently one workman less is required at the mixer.

For street intersection work a special rapid discharge arrangement is used so that the batch is discharged in two or three revolutions into carts which are generally used to take it away.

When using the "cart charger" the mixer can be used above the street level if desired so as to give a down grade for handling of the mixed concrete from the mixer to the forms, and the mixed concrete can then be handled in carts down a slight incline easily and quickly.

The mixer is moved forward as the work progresses by the cable used to draw the carts to the mixer, which can be attached to a telegraph pole, and the mixer pulled forward by its own power.

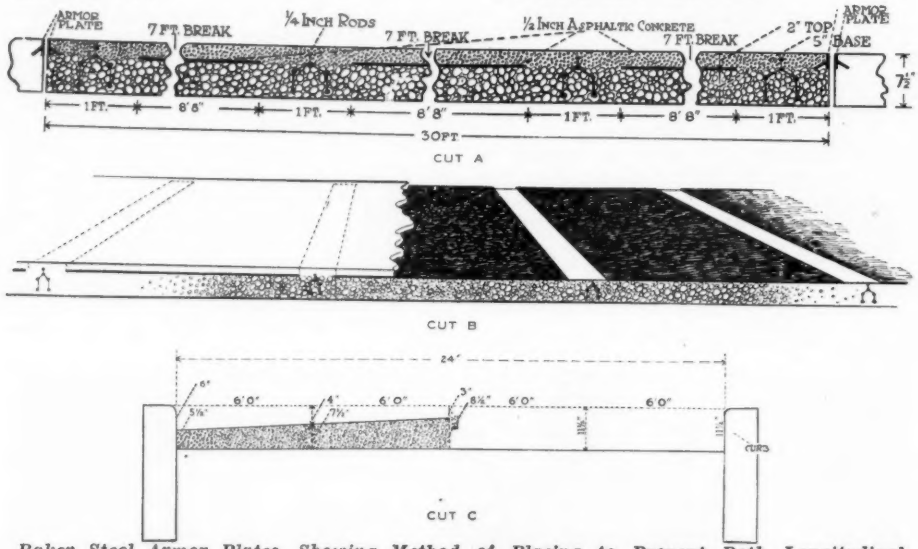
Our crew, which consists of seventeen men (six wheelbarrow men, thre mixture spreaders, two machine operators, two cart wheelers and four cart fillers), average one batch per minute or 1,000 square yards per day.

of a special soft steel, in bars 3-16-inch by 2½-inch, shaped to conform to the crown of the pavement and provided with shear members that tie them securely to the concrete top and wearing surface.

These plates have been in use for experimental purposes for a period of six years, and in general use in Wayne county roads during a period of four years and they have absolutely overcome the one difficulty that threatened the ultimate success of concrete road construction.

Various bituminous preparations, tar paper, asphalt felt, plank, wood block, vitrified brick, etc., which have at times been utilized for joint filler and protection, have proven hopelessly inadequate and have in no case afforded more than merely temporary benefit.

The most pleasing feature of the year's work is the fact that builders everywhere have almost invariably exhibited an earnest desire to obtain the best possible results. This presages well for the future of the concrete pavement.



Baker Steel Armor Plates, Showing Method of Placing to Prevent Both Longitudinal and Transverse Cracks.

Armored Concrete Pavements

By R. D. Baker, of the R. D. Baker Co., Contractors, Detroit, Mich.

In 1906, noting that in the few isolated instances where pavements of the concrete type had been previously constructed, the constant jar of heavy traffic and the blows of hoofs against the unprotected edges of the expansion joints, had invariably resulted in a steadily increasing abrasion, which eventually produced an unsightly rut, annoying to traffic and extremely difficult of repair, I designed a steel armor plate for the protection of expansion joints. These plates are made

Any form of pavement with a solid, unyielding surface is subjected to a greater degree of wear if the surface is uneven than when it is free from depressions and irregularities. The pound and jar of traffic is in direct proportion to the surface roughness, and where the irregularities are pronounced, will inevitably result in the gradual disintegration of the pavement.

Roughness is also a source of severe annoyance to traffic. It means a very perceptible loss of comfort, and places an entirely unnecessary strain upon the passing vehicles. In these days of the automobile, when speed in travel has arrived

at a maximum, this fact is brought home with greater force than at any time in the past, and the loss occasioned by uneven road surface is tremendous.

As shown in Cuts A and B, reinforcement is placed at points where base and wearing surface unite. These rods are placed to prevent longitudinal cracks, which are apt to appear in pavements not reinforced. They also serve to tie surfacing to base when resurfacing.

In several hundred square yards of concrete paving where joints have been placed 25 feet apart no liability to transverse cracks extending from curb to curb was found. For this reason no necessity to reinforce longitudinally is felt.

As an additional precaution against longitudinal cracks, cross section for pavement as shown in Cut C is used.

Pumping Water for Road Work

"Water in sufficient quantities to meet our requirements is not often available in the country districts without some device for carrying it," states Edward N. Hines, of the board of county road commissioners of Wayne county, Michigan. "Hauling it by teams at $5 per day each is an expensive proposition, especially where a single crew, when under full swing, uses about 15,000 gallons a day. To meet this situation pipe lines are laid to the nearest supply, which lines, where they run along our work, are tapped every 300 feet, so that a supply may be available at any point. Fairbanks-Morse 3-h. p. gasoline engines are used to force it to the work. We have pumped water out of the River Rouge a distance of six miles. At least eight teams would have been necessary to do the same work.

"Whenever possible, we use machinery in our work and we find that pumping water for miles is considerably more economical than the hauling of same by wagon. It is not an unusual spectacle to see the large hauling engines of the commission trailing two to four large wagons, each loaded with 7 tons of stone. Graders are also drawn by steam, doing the work of from 6 to 8 horses, and doing it more efficiently and more rapidly. Old roads are rooted up with a scarifier or gang plow. Stone and sand on some of the roads are unloaded with a steam grab bucket, and many smaller economical and labor-saving devices, designed by the commission or its employes, are in use. Cement is mixed in a mechanical batch mixer that moves under its own power, and from which a boom projects, capable of being swung in the arc of a semicircle."

Mixing Concrete for Pavements

By F. P. Wilson, City Engineer, Mason City, Ia.

In the construction of some of our most successful work a mechanical batch mixer with a 25-foot boom, on which there is a traveling bucket, was used, and this mixer is manufactured by the Koehring Machine Company of Milwaukee. After the sub-grade had been thoroly rolled the material was distributed along the street, the rock on one side and the sand on the other. The Koehring mixer was set up at the end of the street 25 feet from the place of beginning. In the first section 12½x30 feet, the concrete was placed. Immediately the wearing surface was placed upon the concrete, not to exceed 20 minutes elapsing between the time the concrete was placed and the wearing surface was placed on same. Then the next section of 12½x30 feet was put in. Then the mixer propelled itself backward 25 feet and proceeded as before.

Parallel with the curb and 10 feet out from the same the wearing surface was cut thru the concrete, these parallel cuts being 10 feet apart so that the actual blocks of concrete are only 12½x10 feet.

The contractor, Mr. George Gabler of Mason City, Iowa, writes: "My average yardage per day on a 30-foot street was 600 square yards. On a 40-foot street I increased this average to 700 yards per day. My best run was 720 yards, and was on a 40-foot street. All of my work was on two-mix work, that is, we laid a 5-inch base with a 2-inch top, which took almost twice as much time to put on as the base. On straight concrete base we could have doubled that.

"My gang consisted of 24 men, counting the water boy, and was distributed as follows: 4 cement finishers, 3 men setting forms, 1 man on odds and ends, 1 engineer, 1 fireman (this man also counted empty sacks, etc.), 1 man handling boom and bucket, 4 men wheeling rock, 3 men wheeling sand, 1 man handling cement, 3 men screening sand for topping, 1 water boy, 1 foreman.

"The above lineup I found to work to the best advantage for my work. I do not believe there is a concrete mixer that can begin to put in concrete paving as cheap and with as few men as I have done with the Koehring special street-paving mixer. The mixer has given excellent satisfaction. We have not had any trouble at all during the past season, having used it for eight months, ten hours per day, with not to exceed three days of lost time, all of which was caused by rainy weather. As to repairs, will say that there were none."

The Thomas System of Reinforced Concrete Roads and Pavements

While the Thomas system of reinforcing concrete roads and pavements is patented it is stated on good authority that no advantage is taken by the company as to the price of the reinforcement, which is uniform to all contractors. "To give an idea of the price at which Thomas system reinforced concrete pavements may be laid," states Mr. F. P. Obennauer, president of the Thomas Steel Reinforcement Company of Detroit, Mich., "I will simply refer to the many square yards of this pavement laid in the vicinity of Detroit for about $1.35 per square yard and this includes a 5-inch course of concrete foundation and a 2-inch granite or crushed boulder smooth-wearing surface. This makes a saving of about $1 per front foot to the property owner, and as the cost of maintenance is practically nothing, also a reduction in the general tax. Miles of this pavement have stood the test of the hardest winters.

"Concrete, whether in a roadway or a building, not properly reinforced, will crack. There is no chance for argument about this point. Concrete with reinforcement which does not provide against all the possible stress is no better than plain concrete.

"A careful examination of the following excerpt from the Thomas system specifications will show to the engineer that the principle is based on sound and undisputed engineering principles:

Reinforcement.

The reinforcement in the mass of the concrete to be placed in the following manner:

The ⅜ round steel bars to be placed longitudinally and crossways 2 feet center to center and 1½ inches from the top surface of the finished concrete. The ¼-inch round steel bars to be placed longitudinally and crossways 4 feet, center to center and 5 inches from the top surface of the finished concrete, and both systems of bars to be well clamped together at their intersections. The two reinforcements to be properly supported in their respective places before any concrete is laid, and in proper lengths and widths so as to be embedded in concrete panels of 30 feet long by the whole width of the road. The top and bottom bars to be held firmly at intervals of 4 feet by an upright steel member, which will make a positively connected unit of the top and bottom bars thru the whole pavement.

Expansion Joints.

Expansion joints ½ inch wide shall be placed at right angles to the curb line at intervals of 30 feet. Joints to have edge protected by means of a soft steel plate, 3-16x3 inches rolled to conform to the established crown of the pavement and said steel plates to be securely attached to the reinforcing bars of the pavement so that the concrete between the expansion joints works as a unit. Expansion joints without steel plates should also be placed along the side of the curb, ½ inch wide and the whole length of the paved street, the opening to extend to the bottom of the concrete base and space to be filled with asphalt filler of an approved brand. This filler is not to be placed until the wetting of the pavement after installation has been stopped.

Thomas Steel Reinforcement in Place in Concrete Pavements. Note Reinforcing Bars in Foreground.

Port Huron All-Steel One-Way Spreading Dump Car.

Steel Spreading Dump Cars

One of the very prominent members of "The Port Huron line" of road-building machinery is the all-steel, one-way spreading dump car. This "car" contains no wood, its construction thruout is of metal; main frame is of channel steel and joints are hot riveted. The dumping devices or levers are low down and convenient for operation by the man while he is standing on the road. The wheels are large and very wide and they have roller bearings. The roller bearing not only reduces the draft, makes the car easy running, but is durable, and at small expense can be easily renewed. Wide and high wheels are necessary to avoid damaging the road traveled, and by the lapping of the front and rear wheels there is made a track 20 inches in width. The wide wheels and the lapping of tracks, together with the great loads, operate like a roller, in smoothing, compacting and putting the road bed in suitable condition. These cars are short turning, because of front wheels turning clear under, and because of extended hitches causing the cars to travel outward and trail nearly in the track of the roller or engine. The "goose-neck" section, or provision for front wheels turning clear under, includes special and extra strong castings, trussing, bracing and tieing by rods, plates and bars.

At many points on many jobs there is sufficient room for turning without uncoupling and this "car" has the advantage of saving time of uncoupling and recoupling.

A regular Port Huron roller with eight or less number of cars attached can be turned completely around in a space only about 30 feet in width, without uncoupling and without backing; any length train can be turned in only 15 feet 8 inches width by uncoupling and using a switch rope. These cars are furnished regularly with spreading dump, but can be furnished with either spreading or full dump, or both. If provisions for changing from spreading to full dump are required an extra door is needed and will be furnished at slight additional cost.

The spreading dump provides for spreading crushed stone, gravel, etc., over the roadway, 1 to 8 inches deep and 4 to 4½ feet wide, according to adjustment of doors, sizes of particles, evenness of ground, etc.

The full dump provides for opening fully and dumping at once in a heap, being designed for quick dumping and for releasing material that flows or dumps less rapidly than does crushed stone or gravel.

"The work of spreading crushed stone mechanically was first invented by us and we built cars for that purpose nearly 13 years ago," states Mr. D. C. Kinch, secretary of the Port Huron Engine and Thresher Company. "At that time we were also interested in building roads about our factories where this car was built for that particular work.

"The work accomplished was such a vast improvement on the old way of hand spreading that we at once saw a great future for the car and commenced building it and an Americanized roller for sale to the general public.

"We are now building a new boiler shop, one end of which will be devoted to the manufacture of these all-steel, hand-steering, stone-spreading and dump

cars and, with improved facilities for manufacturing, we would very much like to work up an increased demand, at least equal to our ability to produce the goods."

Effects of Ornamental Lights

It pays to advertise. It pays not only the city doing the advertising, but it also benefits other cities. It invariably starts things. The street illumination methods of St. Paul, Minn., were widely heralded a few years, ago and Waterloo, Iowa, immediately sent a committee to investigate. They handed in a satisfactory report and immediately commenced a campaign for a similar white way in Waterloo, which was described in the January number.

"Our system of ornamental street lighting is the best advertisement and the greatest step in advancement ever taken by our city," says the mayor of Waterloo. "Now other cities near Waterloo and in distant parts of the country, say the same thing. In fact, all good things are gradually and continuously passed along."

"There is food for reflection in the thought of beautifying," states Mr. W. M. Hinckley, manager of the Waterloo Malleable Iron Works. "Ornamental lighting standards are an ornament by day and a source of light by night. They mean less crime, more business and cleaner streets."

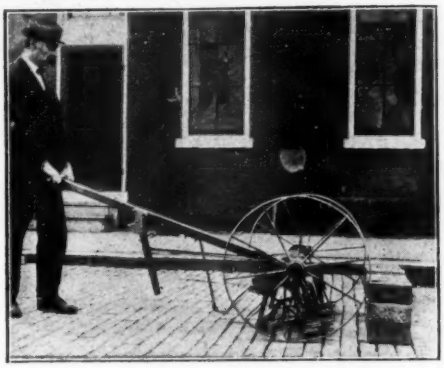
Sterling Paving Brick Cart

"On straight work from side piles our paving brick cart will show a saving of 50 per cent or more under the cost of carrying to the setters with the hand tongs," states Mr. Ward Lincoln of the Sterling Pattern Works, Sterling, Ill. "One man wheeling 36 bricks can deliver them to the setters as fast as six men with the hand tongs. Where the brick can be uniformly and accessibly piled, or in street intersections or alleys, the saving will be much greater, as the carts can be run directly to the brick pile, wherever located.

"The Sterling carts deposit the brick in piles close to the paving line, best side up and without disturbing the line, also with no possible liability of chipped or broken brick. One contractor, who has four carts, said they much more than paid for themselves in laying 180,000 block and another contracting firm who used the carts on straight work from side piles, says the saving in labor cost over the use of hand tongs is more than one-half, the setters were better served, the work was easier on the men, besides the saving in chipped and broken brick was very considerable.

"The carts are designed to carry 36 brick or 30 blocks separated into two piles each six brick wide and three high, with space between.

"For a wide or moderately wide street we would suggest the use of four carts, two for each side of the wagon or from



Sterling Paving Brick Cart.

each side pile, two men for loaders and one man for wheeler for each two carts, one cart being loaded while the wheeler is placing the other. For a narrow street probably three carts will answer, with a man for a wheeler for both sides. The carts are thoroly well made, having roller-bearing wheels 30 inches in diameter, with 2½-inch tire; weight 200 pounds."

Street Sanitation in New Orleans

By Geo. S. Smith, Deputy Commissioner, Dept. of Public Works, New Orleans, La.

Owing to the rapid growth of New Orleans during the past year there is a greater demand for street cleaning, street grading, ditches, new bridges, culverts, footlaps, good streets and better drainage.

The tracer system and clock system are used successfully, while the work of looking after the condition of the streets is likewise facilitated by the reports regularly furnished by the New Orleans Railway and Light Company and the sewerage and water board of all cuts made by them, together with their location.

The complaint clerk keeps in touch with all such cuts thru the foremen of the wards in which they are made, and by constant reminders the department causes the above-named corporations to repair them.

Semi-annual inspections are made of all

Etnyre horse-drawn street flusher in operation.

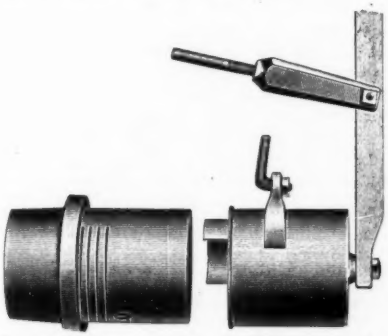
the garbage carts, street cleaning equipment and other paraphernalia employed in the general street cleaning work. New and improved apparatus is always looked into and the gradual enlargement of the service is apparent. At these inspections prizes are offered, which encourage neatness and cleanliness. This has a tendency to effect a complete and efficient service.

Three hundred and forty men are provided for in the department by budget, all in uniform and all variously assigned.

Large and commodious animal barns, stables for horses, warehouses for supplies, a broom factory for the manufacture of brooms, and feed barns are operated by this department and same are surrounded by stone-paved footwalks and driveways. There is good drainage in this section, and the entire place presents a fine appearance.

All brooms used on the street-sweeping machines are manufactured by the men of this department, in the broom factory. These brooms were formerly manufactured at a cost of $10 each. The actual cost now is $1.50 per broom. They are filled with split hickory, purchased in Huntsville, Ala. During the past year 200 brooms were manufactured by the men of this department, thus saving for the city $1,700.

There is a modern veterinary hospital located at our yards, where all sick and injured animals are treated, a wading pool for stock, constructed of brick and cement, and all appliances necessary for handling sick and injured animals can also be found here.



Etnyre patent improved valve. Made of heavy brass and furnished with perforations if desired.

Complete vertical spray sprinkling attachments, readily attached to any style tank on any style of gear.

This plant is equipped with a modern fire protection service, connected with the new water system, while a forty-gallon chemical engine is placed in commission at this barn.

The following stock and apparatus are now housed in the barn: 90 mules, 4 horses, 48 sets harness (double), 14 street-sweeping machines, 12 street-sprinkling machines, 9 flushing machines, 18 dump wagons, 2 egg wagons, 1 spraying wagon, 1 squeegee machine, 1 dump cart, 1 pick-up machine, 1 double-team float.

Our street sprinklers and flushers were made for us by E. D. Etnyre & Co., Oregon, Ill. We use our sprinklers on all kinds of paved streets as well as on all roadways, not paved, but which are subject to dust. Our flushers are used on all paved streets. These flushers clean, on an average, 42,000 square yards per day at an average cost of $0.0475 per 1,000 square yards. The flushers wash everything into the sewers and consequently we have no pickup carts, we use about 300 gallons of water per unit, altho everything depends on condition of streets.

As before stated, we own our teams and equipment thruout. Our drivers are paid at the rate of $2 per day.

The Etnyre patent sprinkling valve is exceedingly simple in construction and easy in operation. It is made without piston rods or packing boxes and does not leak. In the Etnyre patent the outer sleeve moves backward and forward on the outside of the water and shuts squarely against a rubber gasket, located in the shoulder of the valve, making an absolutely watertight joint. The gasket being stationary does not require frequent renewal. There are two valves, one for each side of the wagon, which work independently of each other, controlled by two foot levers at the driver's seat. As the operator releases the lever from the first ratchet in the footboard, which ratchet locks the valves shut, the pressure of water causes the outer sleeve to move backward, thus exposing the slots in the inner cylinders, the desired volume of water being discharged as more or less of the slots are exposed. Thus the lightest spray or the heaviest stream is instantly obtained at the will of the operator. The several ratchets secure the levers at any desired point, thus obviating the method of holding them with the feet. By releasing the lever, so as to expose the open end of cylinder, all trash is instantly removed. The outside sleeve is turned by the operator at the seat end to secure any desired width of spray.

Street and Alley Cleaning

By F. W. Solen, Acting Supt. of Streets, Chicago, Ill.

In the treatment of a city's wastes, while it is always well to be as economical as possible, the matter of cost should be but a minor consideration. It should be the effort of all cities to dispose of the garbage in the most sanitary manner in order that the health of the citizens will be protected. After several years' experimenting in the disposition of Chicago's garbage, and investigation in other cities, it is my belief we have attained this end.

Amount of garbage collected and delivered to the reduction plant in 1911, tons	117,775
Total cost for collection and disposition	$447,740.47
Cost per ton	3.80
Cost per capita	.19.8

There was an increase of 18,275 tons in the amount of garbage delivered to the reduction plant over the year 1910.

In connection with city wastes the subject of miscellaneous refuse is an important one and I believe that such miscellaneous refuse can be treated by a process of incineration, and in order to equip this city with the proper methods of disposal of all wastes both the reduction and incineration methods should be used.

Amount of ashes and miscellaneous refuse collected and disposed of by depositing in clay holes, etc., in 1911, cu. yds.	1,388,200
Total cost for collection and disposition	$825,437.67
Cost per cubic yard	.61.6
Cost per capita	.36.4

The work of street cleaning is as important as the disposition of the city wastes, as it has to do largely with the health and comfort of citizens, and during the past year every effort has been made to expend such moneys given us to keep our streets in as sightly and sanitary conditions as the moneys would allow. The most effective work in street cleaning in thickly settled districts can be accomplished by the "block system," together with street flushing machines, at night.

The work of street cleaning has been greatly handicapped by the lack of convenient places to dispose of street sweepings and it is the intention of the bureau to build additional loading stations in order that we may further utilize the street railways for the hauling of street dirt and miscellaneous wastes.

Under the work of "street and alley cleaning," the following moneys were expended in 1911, distributed as follows:

Number of square yards of pavement cleaned by hand, square yards	2,441,347,873
Cost of hand cleaning	$894,270.68
Cost of hand cleaning, per 1,000 square yards	.37.3
Street dirt removed, loads	201,045
Street dirt removed, cu. yds.	735,334
Number of square yards of pavement cleaned by flushing machines, sq. yds	174,729,127

Cost of flushing.....	$30,365.68
Cost of flushing, per 1,000 square yards.....	.17.3
Cost of street cleaning, per capita	.41.6
Cost of weed cutting.....	3,344.00
Material vouchers.....	17,233.00
Ditching	11,159.24

Total expenditures, $956,372.00.

There is such a splendid organization of the forces that within 24 hours after an ordinary snowstorm practically all traces of the snow are removed from the streets in the "Loop District."

Amount of snow removed, First ward, cubic yards.....	111,177
Cost of removal.....	$45,344.86
Cost per cubic yard.....	.40.7

In the collection of garbage we use a specially designed tank wagon, made by the Bain Wagon Company of Kenosha, Wis. We have over 200 of these wagons in operation, each of which is of 4-cubic-yard capacity.

figured with. "Today a great many of the leading farmers of the country own automobiles," he said, "and it is going to be necessary in a few years at any rate to have the roads in such shape that they can be used by automobiles at all times. In fact, the automobile is fast becoming the farmer's carriage and is not simply a pleasure vehicle either. The farmer who owns an automobile has bought it and paid for it and he hasn't had to spend his last cent or mortgage his farm to get it either. So the farmer who owns an automobile is reasonably certain to pay cash for his goods, to pay his just share for county and township road improvements. Then, too, when he comes to town he doesn't come alone. He brings neighbors, who do not own automobiles, but who happen to have business in town. When they get to town nearly all of them make some purchases and thus the automobile trade from the country is becoming quite a factor in our

Russell Grader on road work.

Graders for Road Purposes

Someone has said that the country county seat needs good roads more than it needs factories. Perhaps a better way to state the proposition would be to say that it needs them both. It certainly needs good roads.

A prominent merchant of Fargo, N. D., in speaking on this topic said, that in conversation with a merchant from one of the neighboring towns recently, he asked him how business was progressing and the answer was "fine; we haven't had as good business for years as we have had during the past week or so."

"I asked him the occasion for this increase in business," said the Fargo man, "and his answer was, 'The roads have been so bad that our people couldn't get to Fargo and so they've been trading at home.' "

Continuing the merchant declared that the large number of automobiles owned by farmers had become an element to be business and that's why the business men of different towns are interested in the good roads movement. In a little trip I took the other day towards Grundy Center, I passed seven automobiles owned by farmers and each one loaded with farmers, coming to town on business. This is only one example of what happened in one day on one of the roads leading to the city, and it wasn't a first-class road either, altho preparations are under way to make it the finest highway in the state, the construction of which will start early in the spring."

The accompanying illustration shows a type of elevating road grader very suitable for just such work as outlined in the foregoing. This grader is made by the Russell Grader Manufacturing Company, Minneapolis, Minn., and in three sizes.

The "Township" or "Size A" is the size very appropriate for building roads. The carrier is 18 feet in length and may be reduced to 15 feet by removing a 3-foot section.

"Contractors Standard" or "Size B" is a much stronger machine thruout, and is especially suited to the contractor's needs. The carrier is 21 feet in length and may be reduced to 15 or 18 feet by removable sections. It is also equipped for wagon loading and has roller guides at outer end of carrier to prevent catching on wagon box.

"Contractors Special" or "Size C" is still larger and stronger than the Standard, and is designed for special work where a very long carrier is required. The carrier is made sectional and can be adjusted to various lengths, so as to convey the dirt from 18 feet to over 28 feet.

Detroit Has Earned Its Asphalt Plant

With the close of the season of 1913 the Municipal Asphalt Paving plant of the city of Detroit will stand upon the records of that city as free of cost. It has just finished its ninth year of service and each year 10 per cent of its cost has been charged off to the cost of the paving operations. The plant is yet in very good condition and will serve for some years to come. The success of the city of Detroit in operating its own paving plant has been notable; this is due to the fact that in that city this branch of the service is free from political disturbances and the city has been enabled to train and retain a very efficient and capable organization under the control of Mr. Haarer, commissioner of public works, and Mr. Clarence Proctor, the superintendent and asphalt expert who came originally to Detroit nine years ago from the laboratory of Mr. Dow.

The city of Detroit is notable for the excellent condition of its asphalt streets. Repairs and also new work have been made at the lowest possible cost to the taxpayers and of the very best quality. In order to still further expand its usefulness this department of the public service of that city has recently given to Hetherington & Berner, the builders of the original plant, a contract for still another plant, one having a capacity of 3,000 square yards of asphalt pavement per day and one that will embody all of the later improvements in plant building.

The Hetherington & Berner Company have built municipal paving plants in many cities in various parts of the country and all of them have done well; at the present writing that company is completing the installation of a very large plant for the city of Chicago and also a plant similar to the Indianapolis plant for the city of Camden, N. J. This company has also recently built and shipped out one of its Model 1912, two-car railway plants, to Canada and a one-car plant to Jackson, Mich., the latter being operated by the Cleveland Trinidad Paving Company of Cleveland.

Trade Publications

"A Fire Department in Your Own Building," is the title of a new booklet by the H. W. Johns-Manville Company, describing the liquid, non-freezing, and dry powder classes of hand chemical fire extinguishers manufactured by that company.

The Chain Belt Company, Milwaukee, Wis., issues a periodical circular of 8 pages; that for January showing a reinforced concrete stairway and pavilion in reinforced concrete with no supports except at the lower end, which is used to gain a general view of the Exposition of Trade, Industry and Agriculture, at Koslin, Pomerania. It is 36 feet high.

Trade Notes

Dow and Smith, well-known chemical engineers and paving experts, have removed their headquarters from 24 East Twenty-first street to the Fifth National Bank building, 131 East Twenty-third street, New York city. Their new quarters are considerably larger than the old and are better equipped for handling the extensive work of the firm.

At a recent meeting of the board of directors of the Union Clay Products Company, New York, Edwin F. Kellogg was elected president and W. W. Dixon, secretary and treasurer. Mr. Dixon has been the leading spirit in the company since its organization. His work, heretofore, has been particularly in the sales department, but under the new management he will be in complete charge of all departments.

The Case 110-h. p. steam engine actually won the gold medal for highest number of points in its class and sweepstakes honors for the highest number of points in any class, at the Winnipeg motor contest. A clerical error made the first announcement incorrect. This engine and many others are made by the J. I. Case Threshing Machine Company, Racine, Wis.

After much deliberation and discussion of various materials the directors of the port of Boston, Mass., on January 30, ordered 63,000 square yards of bitulithic pavement for the first floor of the big Commonwealth pier, 4, 094 square yards of wooden block for the carriage concourse on the second floor and 20,900 square yards of granolithic for the part of the second floor to be used for foot passengers.